THE AMERICAN GAS LIGHT JOURNAL

REDMANRKENNY.N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

LIBRARY OF CONGRESS. OCT 24 1904 SMITHSONIAN DEPOSIT.

VOLUME LXXXI. No. 17. Whole No. 1,533. | NEW YORK, MONDAY, OCTOBER 24, 1904. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

Remittances should be made either by post office order, express money order, registered letter, or bank draft on New York, payable to the order of A. M. Callender & Co.

The American News Company, Nos. 39 and 41 Chambers street, New York, are agents for this JOURNAL. Newsdealers will send orders to them.

Collections are invariably made directly from this office for subscriptions advertisements, etc. We have agents to solicit the same, but they are not authorized to receipt for money.

The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICE—

Where to Find the Western Gas Association's Exhibit and the Custodian Thereof at the World's Fair 641

NOTICE—

Bureau of Information, Ohio Gas Light Association 641

Obituary Minute to the Memory of A. B. Slater, Society of Gas Lighting 641

EDITORIALS—

Special Editorial Correspondence: Thirty-second Annual Meeting, American Gas Light Association 642

Address of the President of the American Gas Light Association (Mr. Rollin Norris), Washington (D. C.) Meeting, 1904 643

Distributing Power Throughout a Gas Works by Means of Electricity Generated at a Central Point, by Mr. W. A. Baehr 645

Proceedings, Twelfth Annual Meeting, Michigan Gas Association 648

First Day, Afternoon Session—Temperature as Applied to the Production and Purification of Coal Gas, by Mr. V. F. Dewey.—Discussion—Second Day, Morning Session—The Formation of Naphthaline in Coal Gas, by Messrs. A. H. White and S. Ball—Discussion.

*Exhibit of the Bristol Company at the St. Louis Exposition. 651

The Care of Switchboards 651

The Production of Natural Gas in 1903, by "W. L. C." 652

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 652

Col. Richardson's Way of Retiring from Business—Hints from Norfolk, Va.—Others from Bloomington, Ills.—Public Lighting, Washington, D. C.—The Massachusetts Gas Companies—The Citizens Gas and Fuel Company, Oxford, Pa.—Changes at Cheboygan, Mich.—A Circular Notice—Another Electrical Exposition for New York City—And Other Items.

The Market for Gas Securities 654

[OFFICIAL NOTICE.]

Where to Find the Western Gas Association's Exhibit, and the Custodian Thereof, at the World's Fair.

To the Fraternity: The exhibit of the Western Gas Association, at the World's Fair, St. Louis, is located in Section 33A, Liberal Arts Building, where Mr. Fred. R. Persons, who is in charge of the same, will always be on hand to receive visitors and to explain anything that requires explaining.

[NOTICE.]

Bureau of Information, Ohio Gas Light Association.

CITY OF LILCOLN GAS CO.,
LINCOLN, ILLS., Oct. 10, 1904.

To the Fraternity: At the last meeting of the Ohio Gas Light Association a Bureau of Information was decided upon, the idea of which is to render assistance to members who may have questions coming up or difficultles arising respecting which they would like some help. This Bureau has been established and is now ready for business. A number of co-Editors have been appointed to whom the various questions will be referred. As this is the first Bureau of Information attempted by any Association, it is hoped that the members will take advantage of its opportunities. The co-Editors are as follows:

Distribution.—E. E. Eysenbach and M. E. Malone.
Accounts and Bookkeeping.—D. W. Low and Chas. Ritter.
New Business and Gas Appliances.—Frank D. Moses, Ralph Woodward and F. Cavanagh.
Chemistry.—H. B. Harrop and Clarence Lomax.
Retort House.—Moses Coombs.
Natural Gas.—W. H. Hammon and Geo. W. Barnes.

All questions should be addressed to the Editor, at Lincoln, Ills.

Very truly yours, H. L. OLDS.
Editor Information Bureau.

Obituary Minute to the Memory of Alpheus Brayton Slater, Adopted by the Society of Gas Lighting.

In the death of Alpheus Brayton Slater, which occurred at his home, Providence, R. I., the evening of June 26th, 1904, the Society of Gas Lighting loses one of its earliest non-resident members, he having joined the Society, April 8, 1880.

Mr. Slater was born in Warwick, R. I., November 26, 1832, and received his preparatory education in the public schools of Newburyport, Mass., and East Killingly, Conn., and the finishing touches were acquired at the Smithville Seminary, North Scituate, and the Conference Seminary, East Greenwich, in his own State.

In 1853 he entered the service of the Providence (R. I.) Gas Company, and in 1858 was appointed its Chief Clerk. In March, 1869, he was elected Assistant Treasurer, and in February, 1870, he was elected a Director of the Company and formally appointed to the dual position of Secretary and Treasurer, which posts carried with them the duties of General Manager. He filled these important positions of trust and responsibility with credit to himself and with profit to his Company, until ill-health compelled him to retire from active service some years ago. To his tact, energy, and forcefulness, the greater part of the commanding position now held by the Providence Gas Company is due, for while he was in its employ his best thought and deed (and they were never wanting) were unsparingly and judiciously used for its advancement.

Mr. Slater was prominent for more than a quarter of a century in the furthering of the best interests of the gas industry through Association work. He was one of the founders of the New England Association of Gas Engineers, and was its fifth President (1882 to 1884); a founder of the Guild of Gas Managers and always a prominent supporter thereof;

an active member of the American Gas Light Association (October, 1873); its tenth President (1889), and named to honorary membership therein, October, 1902. He was also elected an honorary member of the Western Gas Association at its annual meeting in May, 1886.

He prepared many papers on subjects relating to the gas business for the various Associations of which he was a member, which were marked with strong common sense and good judgment, and the general impression made by them was that the author was trying, in a modest and unostentatious way, to help the gas business and to put it on a higher and better plane.

He is survived by two sons and one daughter.

F. C. SHERMAN, C. F. PRICHARD, } Committee.

[Special Editorial Correspondence.]

THIRTY-SECOND ANNUAL MEETING, AMERICAN GAS LIGHT ASSOCIATION.

WILLARD'S HOTEL, WASHINGTON, D. C., Wednesday, Oct. 19, 1904.

Dear JOURNAL: The first day's sessions of the thirty-second annual meeting of the American Gas Light Association have just been brought to a close, and the story of what was done is here narrated in short style. The "New Willard" is everything one could wish for in the shape of headquarters and living place; the weather was perfect, the attendance is of the representative class and in numbers, many. In fact, it looks that those who held out last year in neglecting the proposition to meet in St. Louis, were really the holders of the better side of the argument. But go where you would prior to the assembling, either yesterday evening or the morning of to-day, in the ordinary gathering spots of such a hostelry as this, he would have been deaf indeed who did not hear something said in sorrow and in praise of the late Captain William Henry White, whose services to the Association, in its early days as Secretary, later on as its President, and always an active worker in its behalf, can never be repaid, save through the lovingness of his live fellows who labored long in the field that years ago held as many stubbles as it now does golden grain. However, the crown of his real worth was certainly memorially put on his head to-day, if speech expression can fix a crown of merit, of worth and of respect and love. President Norris called the first session to order at 10:15 A.M. to-day, and introduced Captain J. Johnson Morrow, U.S.A., acting engineer to the Commissioners of the District of Columbia, who welcomed the Association to Washington in terms well fitting the occasion. The introductory formalities at an end, President Norris went right along with the business order much as a veteran would, which rather went to show that his tutelage during the Gas Congress last summer at St. Louis had been of an instructive sort. Routine business naturally took first attention. Prominent therein were these items: The election of new members resulted in the placing of 91 names on the lists, classified as follows: Active, 44; associate, 25: junior, 22. The new members present having been introduced, Secretary Forstall read the report of the Council, which was more than usually interesting. Among other items it was recommended that the salary of the Secretary and Treasurer be increased to the sum of $750 per annum, and that an additional sum of $250 be allowed him for clerk hire. The report was adopted, as were the reports of the Secretary and Treasurer. The former named report showed an appalling obituary list, no less than 16 names having been added to the mortuary roll, of whom 5 had served the Association in a Presidential capacity. Next followed the report of the Trustees of the Educational Fund, which seemed to disclose a satisfactory state of affairs to those administering it. President Norris called Vice-President E. G. Cowdery to the Chair, after which came a report from the Committee on Research. That disposed of, President Norris read his inaugural message, which document was certainly original, in that it was largely a plea for concentration of business interests. In fact, it was for more on that order, since its lines bristled with thought as to the good that would come from every profitable gas undertaking being managed by one corporate body. The message, however, did not hold out much comfort to the ones who are taking chances at blazing the way for plants in new locations, that to the commonplace investing speculator might seem to have a chance for growth. The address having been referred to a committee of three, an election for officers was entered into with the following result:

President—Mr. Edward G. Cowdery, St. Louis, Mo.
First Vice-President—Mr. Charles F. Prichard, Lynn, Mass.
Second Vice-President—Mr. Charles R. Faben, Toledo, O.
Third Vice-President—Mr. Alfred E. Forstall, New York city.
Secretary and Treasurer—Mr. George G. Ramsdell, New York city.
Members of Council—Messrs. E. H. Earnshaw, Phila., Pa.; H. L. Doherty, New York city; William McDonald, Albany, N. Y.; Andrew A. Quinn, Newport, R. I.

This list, of course, showed quite a change, and it showed some reversal of the strictly legal interpretation of the laws of the Association that have been followed for some years by, with and of the advice of the Council. But as the Association acquiesced, there is small cause for cavil, we presume. Mr. Forstall laid down the heavy burden of the Secretary-Treasurer's place, but retains the administering of the Educational Fund, and will in due time serve the Association as its presiding officer. All of our readers though will no doubt agree that Mr. George G. Ramsdell is quite up to the task of evenly balancing the weight that Mr. Forstall declined longer to carry. The consideration of a short topic on an experience with reinforcing a low pressure street main system by high pressure mains brought the first session to a close.

The afternoon session was convened at 2:30 P.M. The first number was the paper by Mr. E. H. Earnshaw, of Philadelphia, whose chapters on "Oxide Purification" brought out a rattling discussion. At the conclusion of the latter the author was rewarded by the extending to him a vote of thanks of the "rising order." Mr. A. G. Glasgow, happily well recovered from the severe siege of illness that beset him about a year ago, having reported from the Committee on President's Address, the Association listened to the papers on "Generation of Steam by Waste Heat from Water Gas Sets," respectively prepared by Messrs. D. McDonald, Louisville, Ky., and A. B. Macbeth, of Kansas City, Mo. The discussion on these ended the first day's sessions. The reports respecting the trade are better than any I have heard at an American meeting for at least 3 years.—S.

WASHINGTON, October 20, 1904.

Dear JOURNAL: No time was lost in getting the meeting underway to-day, for shortly after 10 A.M. the Association was discussing the lengthy paper on "Consumers' Meters," by Mr. B. H. Spangenberg, of Philadelphia, and a warm discussion from the thought of men who knew whereof they spoke it was, for its participants included the Messrs. McIlhenny, senior and junior, William McDonald, John Gribbel and Chas. H. Dickey. Milwaukee, Wis., was chosen as the next meeting place. Just before adjournment, Mr. Alex. C. Humphreys, President of the Stevens Institute of Technology, advanced to the rostrum and in a clever speech, presented, in the name of friends in the Association, to Mr. Forstall a silver service, which the recipient accepted. The gavel fell at 1 o'clock P.M. The debonair Mr. Dickey and his associates on the committee to entertain the gentler sex are having their metal tested respecting the task set, for no less than six score of the "rulers of the world's rulers" shared in the glories of the ride to Washington's points of interest, and partook of the lunch at "R's." this morning.—S.

The afternoon session was convened at 2:45, and the first business was the finishing of the discussion on the Spangenberg paper. The sum of $200 was appropriated for the expenses of the committee charged with the task of attempting to secure "team work" from all the Associations. Next came the paper by Mr. F. W. Frueauff, Denver, Col., on "Methods of Charging for Gas." The paper brought out a very interesting discussion. On motion of Mr. E. G. Cowdery, the paper by Mr. W. A. Baehr, St. Louis, on "Distributing Power Throughout a Gas Works by Means of Electricity Generated at a Central Point," and that by Mr. W. B. Calkins, St. Louis, Mo., on "A Rapid Method for the Determination of Total Sulphur in Gas," were taken as read, and a short discussion on each was had. On motion of Mr. Thos. D. Miller, the report of special jury of awards, World's Fair, St. Louis, asking the indorsement of the Association, was adopted. The usual votes of thanks were passed, after which a recess was declared, the same to terminate at the completion of the boat trip to-morrow. The attendance (over 200) was excellent and the meeting was in every sense a success. And right here I want to say that the local committees on arrangements and entertainments did not leave a thing undone that should have been done. Their work was simply perfect.—S.

Dear JOURNAL: 'Tis just after the banquet, the pleasure of which were shared by 225 guests. No one could have asked for a better spread, which did credit to the hotel people. The presiding genius at the feast was Mr. Walton Clark, as toastmaster, who cleverly kept the flow of reason in channels that were entirely free from devious windings or hidden obstructions. The speeches were enjoyed, and the best way to sum it up is that everyone present was glad that he did not miss it. The prospects for the boat ride are excellent; in fact all that is required for the best satisfaction of those who are to make the trip will be good weather conditions.—S.

Address of the President of the American Gas Light Association (Mr. Rollin Norris, Phila., Pa.) on the Occasion of Its Thirty-Second Annual Meeting, Washington, D. C., Oct 19-21, 1904.

During the past year the hand of death has been laid so heavily on our Association that I feel I must speak of it in some detail before passing to the rest of my address. As shown in the report of the Secretary, the Association since its last meeting has lost 16 members by death. The first meeting of this Association was held in 1873, and between that date and last October 4 Past-Presidents died. During the past 12 months, however, death has claimed 5 Past-Presidents, or more than all who had died in the preceding 30 years.

Alpheus B. Slater, of Providence, R. I., died on June 26, 1904. Mr. Slater was President of this Association in 1889, and at the time of his death was one of our honorary members. For many years he was General Manager and Treasurer of the Gas Company at Providence, and took a prominent part in the meetings of the Association.

William A. Stedman, of Brooklyn, N. Y., died on October 8, 1903. Mr. Stedman was President of this Association in 1884, and his active participation in association work was principally while he was in charge of the Gas Company at Newport, R. I. At the time of his death he was associated with the Gas Company at Flatbush, L. I.

Joseph B. Crockett, of San Francisco, Cal., died on December 24, 1903. He was President of this Association in 1898, and up to a short time previous to his death was President of the San Francisco Gas and Electric Company.

Andrew Hickenlooper, of Cincinnati, O., died on May 12, 1904. Gen. Hickenlooper was President of this Association in 1882, some 22 years ago. He was formerly President of the Cincinnati Gas and Electric Company, and as the head of the gas interests in that city he was a very active and aggressive manager, and a power in his profession.

William Henry White, of New York, died on July 3, 1904. Captain White joined the American Gas Light Association at its first meeting, April 16, 1873, and was its President in 1892.

"Cap." White! Probably no man in the Association was better known or had more friends, and certainly no other one man has contributed as much as he to the interest and pleasure of the other members. As a graceful, witty and effective speaker he was without a peer in the Association, and as Toastmaster he presided with success and distinction over many of our banquets. A regular attendant at our meetings for 30 years, his bright and gay personality gave him a unique position in the Association, and his death leaves a vacancy that will not be filled.

Charles L. Scott, of Philadelphia, Pa., died on January 14, 1904. He was Secretary of the Pennsylvania Gas Improvement Company, whose headquarters are in Philadelphia.

W. P. Callahan, of Dayton, O., died on January 17, 1904. He was a Director of the Dayton Gas Light and Coke Company.

James E. Burke, of Princeton, N. J., died on February 22, 1904. Mr. Burke was Secretary and Treasurer of the Gas Company at Princeton.

Thomas Littlehales, of Syracuse, N. Y., died April 10, 1904. Mr. Littlehales was formerly Manager of the Gas Company, of Hamilton, Ontario, and took a prominent part in the proceedings of the Association. From Hamilton he went to Syracuse, N. Y., as Manager of the Gas Company at that place, and at the time of his death was associated with the Semet-Solvay Company, of Syracuse.

John W. Reilly, of Wilmington, N. C., died on May, 3, 1904. Mr. Reilly was with the Consolidated Railway, Lighting and Power Company, of that city.

L. S. Wells, Superintendent of the Canton (O.) Gas Light and Coke Company, died on July 14, 1904.

Charles W. Blodgett, of New York, died August 25, 1904. Formerly Engineer of the Williamsburg Gas Company, Brooklyn, N. Y., Mr. Blodgett was later closely identified with the Providence Gas Company as Consulting Engineer.

Oscar B. Weber, of New York, died on September 16, 1904. He was Manager of Adam Weber Sons, firebrick manufacturers, and his bright, sunny disposition made him a well known member of the Association.

George B. Edwards, of New York, died during the past year. He was formerly the New York representative of the Goodwin Meter Company.

E. S. Platt, Secretary and Treasurer of Platt & Company, firebrick manufacturers, died on November 6, 1903.

D. Lewis Bartlett, of Baltimore, Md., died on February 22, 1904. Mr. Bartlett was General Manager of Bartlett, Hayward & Company, of Baltimore, and represented the third generation in that firm.

This is an unusually long death roll for our Association, and the prominence of the men included in the list makes the loss to the Association particularly heavy. The record of the work they did for the profession should be an encouragement and a spur to us to do our best in our turn and leave behind us a record which will help those that come after us.

In choosing a subject for discussion in my address it has seemed to me that instead of attempting a somewhat unsatisfactory review of the progress of the gas business for the past 12 months, it will perhaps be better to talk about a subject which is very close to me, even though it may not appeal to all of you as a matter of direct personal application.

It will, therefore, perhaps not be inappropriate for me to ask you to listen to a few words on the general subject of united management, as viewed by one whose professional life has been principally under such a system and along lines which have brought him in direct personal contact with both the home office and the local operating men.

The soundness of any system can be superficially judged by the extent to which it conforms to the general laws of economic progress, and no system can prosper long that does not thus conform.

The marked tendency of development in all lines of technical and commercial activity during the past 20 years has been along lines of specialization and associated effort. The result of this movement is seen in the organization of vast corporations to direct and control the various branches of manufacture, transportation and distribution.

The most economical method of doing work requires usually the expenditure of large sums of money for the most efficient machinery and the most able management. Consequently a man who has saved up a little money and who wants to invest it in a productive business can usually do best by associating himself with a lot of other men similarly situated, and so getting the advantages of doing things on a large scale and with the most efficient equipment. Hence the corporation and its rapid spread into all fields where large capital is a requisite of low cost of product.

A similar economic law working on a larger scale tends to produce in turn aggregations of various corporations, with the attendant increase in power and effectiveness, and this tendency shows itself in trusts, pools, combinations of various kinds, and in the so-called "community of interest."

So the formation of "parent companies" controlling from a central office a number of gas companies would seem to be in harmony with the general trend of sound economic development, and to that extent at least would seem to be justified.

But let us consider in more detail some of the advantages of this form of management. In discussing this subject I disclaim all allusion to the success or failure of any existing companies to so handle their business as to have realized all the possible advantages of the system, or to have avoided its disadvantages, and I shall endeavor to treat the subject in a somewhat abstract manner. The advantages of united management as they appear to me are as follows:

1. *Uniformity of Records.*—The system allows the use of a uniform system of records, which will tell exactly what each company is getting in each department and allow the intelligent comparison of methods.

2. *General Adoption of Individual Improvements.*—Where any one member of the combination effects an improvement in methods or results, the other members can promptly get the benefit of it.

3. *Availability of Consulting Specialists.*—No one man can be a specialist in all branches of his business, and a single company, except in the case of the largest cities, cannot afford to have on its payroll a lot of high-class men each of whom is experienced and specialized in his own line of work; but a large number of associated companies can afford to maintain a central office thus equipped with a corps of trained experts who will be available for consultation with the local managements when needed. And these consulting men, from studying their particular problems for a large number of different companies, have the opportunity of accumulating more experience in their specialty than if associated with a single company, and this should result in a higher technical and commercial efficiency all along the line.

4. *Protection.*—Raiding and blackmail in various forms are possibilities for most public service corporations, and a company that has available the information and resources that come with associated management is in a much stronger position than the isolated company, and better able not only to prevent such attacks but also to carry on the fight if it cannot be avoided.

5. *Research Work.*—Here again associated companies should have the advantage over the isolated corporations. A sympathetic and pro-

gressive central management should be able to encourage and stimulate effort along sound lines and discourage the waste of time and money in "rainbow chasing," while at the same time they can post the local managers as to what progress has been made elsewhere in solving similar problems, and save the waste of parallel effort, either successful or otherwise.

6. *Economy in Purchase of Supplies.*—A central purchasing department, working in close touch with the local managers, should be able to purchase supplies at a lower average price than the individual purchaser. Not only is there the advantage that comes from the larger quantities to be bought by a central purchasing agent, but his scattered affiliations enable him to keep closer track of changes in trade conditions than can a man who purchases for only one comparatively small concern. Moreover, the purchase of material and supplies in large amounts, based on one set of specifications, makes it much easier for the manufacturer to afford to make changes in his product, which, even though improvements, he perhaps could not afford to do for a small order. This, of course, is an advantage which belongs to united management on account of the larger quantities of material to be bought, and is not inherent in the system itself.

7. *Enthusiasm.*—There are few men who do not do their best work when fired by a spirit of enthusiastic interest in what they are doing, and when a number of men are working side by side for some common end, this association of itself promotes a spirit of interest and optimism that is wanting in the life of a man who, except for an occasional attendance at a gas convention, rarely meets anyone who knows anything about the gas business or cares anything about it. The rousing and fostering of this spirit of enthusiasm is not a necessary accompaniment of united management, but is a valuable possibility, and its existence or otherwise depends very largely upon the wisdom shown in selecting the men of the central office who visit and correspond with the local managers. These visiting men must have ability and experience enough to command the respect and confidence of the local men, and tact enough to demonstrate that they are there to help the local men to better results, and are not there to pick flaws in a spirit of carping criticism.

And this brings up the point that, in consolidated gas management as in consolidated management of all kinds, success is not to be looked for simply because of the consolidation of a number of properties under one general head. The failure to realize this is the fatal mistake that has caused many consolidations to come to grief and caused many men to conclude superficially that the system of consolidated management is fundamentally weak. The real secret of success lies in the requirement that the general management must *know the business.* Without this knowledge, the larger the combination the more certain is it to fail in its purpose.

8. *Cheaper Local Managers.*—One of the advantages sometimes urged for united management is that it enables the companies to be run by cheaper local managers, as the problems calling for high priced talent to solve them can be referred to the central office. While this may and may not be so to a certain extent, I believe that a central management will fall far short of its possible success that assumes that any sort of organization will make it pay to have cheap local representatives. The aim of a central management should not be to use cheaper men and get as good results as isolated companies, but to use the same or better men and get much better results.

9. Another advantage that accompanies the system of united management, although it is not of itself dependent upon the system, is the opportunity to train and develop men; the opportunity to shift men from smaller to larger responsibility as the men develop, and to place them where they can both work to advantage and at the same time grow. This is an opportunity that the single company has only to a limited degree. If the more important and best paid positions in the combination are to be filled by promotion from below, it is the part of wisdom to provide the raw material for such promotion, and if there is always to be a supply of men ready for promotion when the chance arises it will almost necessarily follow that the supply will frequently exceed the demand, and this surplus of carefully trained men should be available to fill positions that offer outside of the combination. The consolidated companies have the opportunity of judging of the men they train and should make it to the advantage of the best of them to stay in the field, but the training of more men than needed should be regarded as a necessary and desirable form of properly organized united management.

Now for the disadvantages of united management. The advantages are apparent, and with one exception to which I shall allude presently, the principal arguments urged against united management are based on the difficulty of so organizing and operating as to obtain the possible advantages I have just mentioned.

Where the consolidation embraces a number of large properties the business becomes a very large one, and it is hard to get men at any price who are able enough and broad enough to handle problems on so large a scale; but they can be gotten. It is also hard to get just the right men for the travelling jobs—but they can be gotten or made; it is perhaps hard to draw the line between discouraging the local men from what I call "rainbow chasing" and discouraging initiative of all kinds. But these difficulties are not at all insuperable, and they appear to me to be difficulties and not arguments against the economic soundness of the system of united management.

There is one phase of the system, however, which has been advanced as a weakness, which cannot be so briefly met, and this is the charge that the system of united management tends to retard or prevent the full development of the individuality of the local managers.

This is a serious charge, and if true to any marked extent would neutralize many of the advantages of the system. For a system to be sound must be self-supporting; that is, it must develop from its own ranks the material for promotion, and if men outside of the system develop into stronger men than those inside the consolidation is met with a dilemma. Either it must be content with filling the most important and best paid positions with men who are not as strong as men in the outside companies, or it must go outside of its own ranks for its best paid men. The first course would be manifestly unwise and the second would be suicidal, as it would detach from its minor ranks all men of ability and ambition, who would at once realize that avenues to promotion were closed and would seek other positions.

But is it true that the system of united management tends to prevent the development of its local representatives? As the result of a good deal of careful thought and close observation, I believe that the question cannot be properly answered by a categorical "yes" or "no."

Responsibility undoubtedly develops a man, and the system of united management provides for someone with whom the local men can consult when in difficulty, and to that extent reduces the otherwise undivided responsibility of the local man. And there are some men who are weak enough or mentally lazy enough to shrink from responsibility whenever they can. With such men I have seen a marked tendency to throw all decisions on the home office where possible, and such men undoubtedly develop more slowly and to a less extent than they would if they were thrown entirely on their own resources. Men of this stamp, both for their own sakes and for the interest of the company, should not be retained under a system of united management.

But where the local man is one of ambition and real strength, the opportunity for consultation with experts, which for the weakling is a source of deterioration, is for him an opportunity for broadening his knowledge; an opportunity of which I have found him very ready to avail himself.

For the man of rather neutral stamp, rapid and thorough development will depend upon the wisdom of the methods followed by the central office in organizing and handling the work. If the central office falls into the error of assuming all responsibility for the various petty details of local management, and by implication or direct instruction conveying the idea to the local man that he is merely to carry out ideas which will be supplied to him from the central office, the effect on the local man must necessarily be stifling to his full development and power of initiative. If, on the other hand, the central office in its intercourse with the local man takes the tone that the local man is running the business, and is expected to do his own thinking, and that the central office's function is to advise and decide doubtful problems, the results in the broadening of the local man's methods and habits of thought are most gratifying.

And here I would again allude to the fallacy of thinking that under a system of united management the work can be carried on by a cheaper and less able grade of man than is required for isolated companies of the same size. To get the best results out of united management the local men must be able not only to originate ideas and carry them out, but they must be able to absorb the ideas of others, assimilate them and put them into successful practice. And this requires a bigger man and should give correspondingly better results than can be obtained by the average isolated company.

To sum up the preceding, it may be said that united management is a development of the same underlying philosophic principle as has in the past couple of decades shown itself in the growth of *team work* in athletics. Each man in a properly selected and balanced team gets more individual development than if every man worked according to

his own ideas, and the effectiveness of the combination is increased immeasurably.

The discussion of the advantages and disadvantages of united management leads naturally to the consideration of another form of united effort in the work of Gas Associations.

The recent enthusiastic action taken at the Gas Congress in St. Louis, in connection with the address of President Shelton, of the Western Gas Association, and a paper by Mr. H. L. Doherty, read before the Congress, shows the existence of a general feeling that our Gas Associations are not getting the results they should, on account of the absence of good "team work." This desire for progress and the instinctive feeling of the line along which progress will naturally develop, is, I think, an encouraging sign in our Association work, and the effectiveness of such work will, I believe, increase in proportion to the extent to which our Associations learn to work as one body. I do not mean that the final form of gas associations will necessarily be a single National Association with local branches, nor do I wish to forestall the recommendations which will in due time be made by the Committee appointed to consider this subject, but I believe that even if there be no organic connection between the various associations, their work will undonbtedly be best performed when each forms a part of an intelligently designed team and each member of the team does the work for which its location and opportunity best fit it.

I am a very strong believer in the usefulness of State and minor Associations, and heartily believe that any modification of Association organization which would reduce the interest and activity of these minor bodies would be a serious injury to the profession; but it seems self-evident that the best total result will be obtained when the Associations work as a team and the State Associations do not attempt to do the work which a National Association—or National Associations, if the country is too large for one—can best do, and when the larger Associations do not fritter their time away in trying to do the work which can better be done by minor Associations.

Distributing Power Throughout a Gas Works by Means of Electricity Generated at a Central Point.

[A paper prepared and read for the Thirty-second Meeting of the American Gas Light Association, by MR. W. A. BAEHR, St. Louis, Mo.]

During the past five years much has been written regarding the economy of steam turbines and gas engines over that of steam engines for power plants; but, as far as the writer knows, no one has as yet discussed the gas engine as a driver of electric generators for conditions existing in a typical American gas works. However, I wish to refer you to an excellent paper entitled, "The Steam Consumption in a Water Gas Plant," by Alten S. Miller, published in the Proceedings of the American Gas Light Association, Vol. XVI., 1899, in which a short discussion of a steam-driven electric power plant in a water gas works is presented.

The object of the present paper is to show by actual test the steam consumption of a typical gas works under normal conditions, and to prove the economy to be gained by the installation of a local gas-engine driven electric plant, replacing certain steam engines and steam pumps by others which can be practically operated by electric motors. The writer has endeavored to prepare a paper which will not only appeal to you, because it is more than a mere theoretical presentation of the case, but which will contribute its mite towards bringing attention to that most promising of all modern prime movers, the gas engine. We cannot only successfully install gas engines to reduce our station costs, but at the same time we may also educate others to appreciate the value of these machines.

The plant selected for the tests is that known as Station "A," Laclede Gas Light Company, St. Louis, and probably represents the typical gas plant, in that it consists of a water gas department of 8,000,000 cubic feet daily capacity, and a coal gas department of 3,500,000 cubic feet daily capacity. Station "A," which was originally built in 1848, was rebuilt from time to time, but portions of the old apparatus still survive, in form at least, and thus this plant represents in a measure the rapid strides that have been made in gas making apparatus, from the old, hand-fired benches of 3's of 1848 to the modern 11-foot water gas sets of 1903, all in operation at this date. The plant equipment is, therefore, not modern, but typical, as the results will show.

The station has one main boiler plant consisting of six 225-horse power Heine water tube boilers, 4 of which are operated at this season of the year. From these the steam is fed some 200 feet through the water gas department to two 17 by 16 simple, non-condensing Ideal engines, driving the blowers supplying the water gas blast, the exhaust steam heating the feed water for the boilers. Another branch of steam pipe runs some 700 feet in the opposite direction, and supplies on its way boiler feed, tar and ammonia pumps, some 7 exhausters and 4 high pressure blower engines. It also heats buildings and the holder during the winter months. The steam piping is mostly 6-inch and is covered with 85 per cent. magnesia. It is erected out of doors for some 200 feet of its length.

The steam consumption of each engine and pump was found by condensing the exhaust steam in a surface condenser and allowing it to flow in one of two tanks where it was carefully weighed. This was also done with all steam traps and drains along the lines of pipe. I will not describe the tests in detail, as you are all no doubt familiar with such work. The results of the tests, which constitute the valuable feature of them, are best summarized in a tabular statement, which is herewith attached.[1]

The column "Total Energy in Steam" represents the total B.T.U.'s, put into the steam from 8° F. feed water temperature to 120 pounds gauge pressure, and which leaves the boiler during 24 hours.

The column, "Energy Delivered by Machines," shows the theoretical work done by the various pieces of apparatus, and is derived as follows:

For the Ideal engines the work done in the cylinder was calculated from indicator cards and converted into B.T.U. For the exhausters, the gas was metered and pressures recorded; thus the work done was calculated. In figuring the high pressure blower engines the R.P.M., gas pressure at outlet of blower, and indicator cards were taken. We assumed 40 per cent. slip on the blower, and kept the by-pass closed during the test. In the pump test the liquids were actually measured and the pressures pumped against duly recorded; except in the case of the boiler feed pumps, where the water meter readings were taken.

Of course, the temperature of the condensed water in all cases was accurately measured. We found the total water evaporation in 24 hours from the water meter readings, said meter being placed on the cold water inlet to the feed water heater. The exhaust steam from the Ideal engines passes through this feed water heater, and to the total water meter reading for 24 hours we added one-eighth of this meter reading, because we found from the water temperatures that it took 1 pound of exhaust steam to heat very nearly 8 pounds of feed water from 80° F. to feed water temperature. The heater did not run over during the test, the float regulating valve being in perfect order, and no water was wasted into the sewer. Our city water pressure averages 25 pounds per square inch.

The steam used in the water gas generators was found by subtracting the amount resulting from the remaining apparatus from the total evaporation in 24 hours, and thus includes the leakage and unaccounted for steam. Since all the foregoing tests could not be made in 1 day, we simply averaged all the works' results for the total period over which they extended. No single test period was less than 8 hours, nor over 26 hours.

The table plainly shows the steam distribution among the water gas, coal gas and mixed gas departments. The low efficiency in all cases is probably due to the long steam lines; that is, wet steam. Thus, coal gas exhauster No. 1 requires almost as much steam per 1,000 cubic feet as the 2 water gas exhausters, though the engine has a smaller cylinder and higher loading.

The cost of steam is based on present boiler room costs of labor and material.

The column "Total Motor Efficiency" represents efficiency of transmission and conversion from the switchboard to the outlet of the exhauster or pump, and upon this is based the kilowatt hours required. The column "Kilowatt Hours Required" is derived from the column "Energy Delivered by Machines in B.T.U." divided by the efficiency, and, of course, converted into energy units.

In further explanation of the column, "Total Motor Efficiency," I will say that we figured these as follows: In the case of the Ideal engines, we could supplant these by electric motors, and, by direct connection to the fan shaft, eliminate the mechanical losses in the engines and the loss in the belt drive, which together are about 10 per cent. The efficiency from the switchboard to the motor shaft would be at least 80 per cent., which would partly offset the 10 per cent. gain above, and leave a certain net efficiency of about 90 per cent. as given in the table. This appears high because it is figured back to the theoretical work done in the engine cylinder. In the same way we figured the actual motor efficiency from the switchboard to the outlet of exhausters and blowers as follows:

1. See table, p. 648.

	Switchboard Output.
Line loss	3 per cent.
Actual motor loss	15 "
Mechanical losses in connecting devices (such as silent chain)	5 "
Losses in the machines	7 "
Total	30 "

In the case of the electrically driven pumps, I feel we are safe in assuming their efficiency to be at least equal to 60 per cent. of the switchboard output. From the table it will be seen that the total steam cost per day is $144.63. In installing electricity we would drive only such machines with motors as have been enumerated in the column of electric costs. It should be understood that we already use electric motors for driving machine tools, elevators, various pumps, cooling tower fans, etc., and electricity for lighting the plant. This current is derived from our electric plant, situated about 2 miles from Station A. It amounts to about 1,440 kilowatt hours per day, with a demand of 105 kilowatts. From the column, "Kilowatt hours per day required," we have 5,764 kilowatt hours per day on a demand of 261 kilowatts. This makes our total current consumption 7,204 kilowatt hours on a possible demand of 366 kilowatts. It is not reasonable to suppose that this maximum will occur, but we will make provision for it, as we will undoubtedly be able to use a little excess capacity in the course of time. From the total consumption of 7,204 kilowatt hours per day we derive our average load of 300 kilowatts, all on the switchboard. In figuring the demand of 261 kilowatts it should be noted that the high pressure blower engines require 878 kilowatt hours per day, when pumping against an average gas pressure of 4 pounds per square inch, whereas the maximum pressure is 5 pounds.

The steam costs which would be affected by the electric installation now amount to $87.84 per day, thus leaving $56.79 per day for steam used in water gas generators, certain pumps and that lost by condensation. Since a question might be raised as to the practicability of driving the coal gas exhausters electrically, I will say that an ordinary float governor could easily be arranged to either actuate a rheostat or a valve in a by-pass to the machine, and thus a fair efficiency be maintained.

The long steam lines, low thermal efficiency, and the fact that the load is exceedingly variable on most of the engines, strongly recommend the electric motor drive with its high efficiency and simple means of transmission, especially its high efficiency for variable loads as compared to the steam engine. The conditions for loss by condensation were, at the time of making these tests, such as to make them a minimum. A temperature of 90° F. of the atmosphere makes this loss 60 per cent. of what it is during the winter months of 0° to 10° F. atmospheric temperature, assuming such losses proportional to the difference in temperature between the air and steam.

We have figured that there are only 3 feasible methods of driving the electric generators; namely, by using uncarburetted water gas from the water gas generators, or by manufacturing producer gas for a gas engine drive, or by installing steam units, utilizing the capacity of the present boiler plant. If we attempted to use city gas in the gas engines the expense of running them rises considerably above the cost accruing from the producer or uncarburetted water gas installation, and we have, therefore, omitted the city gas calculation entirely; but it must be borne in mind that the tabular steam costs are only the cost of material and labor in the boiler room, whereas the electric rate of 1 cent. per kw. hour includes interest, certain depreciation and certain operating expenses. This method of calculation was purposely adopted to give an additional factor of safety for the argument in favor of the electric drive, and a more detailed explanation follows.

The uncarburetted water gas from the water gas generators could be simply tapped off from the primary scrubbers and run into a separate relief holder. It might be necessary to add an air blast with the steam for manufacturing this gas, as the pure, uncarburetted water gas is very difficult to work in gas engines. Four uncarburetted water gas sets run every 3 hours from one of our 11-foot water gas sets would provide all the gas needed for the power plant. Between the separate relief holder and the gas engines a tar extractor or scrubber would be placed. The relief holder is figured to contain enough gas for about 2 hours' supply of the uncarburetted water gas, and about 1 hour's supply of producer gas. I realize that the large percentage of hydrogen in uncarburetted water gas renders high compression impossible, but still feel that the given efficiency could be obtained by adding air if necessary as above stated, or by improvements in the gas engines themselves.

The producer gas installation could be either of the pressure or the suction type. It is not the intention in the present paper to discuss the relative merits of these systems.

The steam system was calculated to consist of 2 compound steam engines, direct connected to "D. C." generators, and having added the necessary condensers, etc., and using steam from the present boiler plant. We did not consider the steam turbine, since no existing type allows of direct connection to "D. C." generators in this size on account of the high rotative speed, and the De Laval gear may be considered objectionable.

We selected 220-volt, 3-wire "D. C." distribution, because there is so much variable speed work at our plant that "A. C." motors at present are practically out of the question. If we are supplied with "A. C." motors that can be very economically regulated, the alternating current proposition may become very attractive. I do not consider the question of sparking at the commutators of "D. C." motors as extremely objectionable in a gas works, because there is no necessity of locating them in places where an explosion might occur. Besides, to-day there is no perfectly satisfactory type of "A. C." elevator motor on the market, at least, not to the writer's knowledge, and our elevators for raising coke to the water gas operating floor are electrically driven.

We selected multiple-voltage, 3-wire distribution, because the all-day efficiency would be about 10 per cent. higher for variations in motor loads from 50 to 100 per cent. The third wire is figured to be connected to the neutral point of an equalizing outfit or motor generator set. The maximum voltage of 220 is not dangerous to life; the 110 or 220-volt motors are built of slow-speed type, well adapted for the various uses we require, and either voltage can be used for lighting. This system works out beautifully for balancing loads at all times and thus maintaining the highest efficiency.

Gas Costs.—From careful estimates we should be able to manufacture this gas for from 7 to 9 cents per 1,000 cubic feet, and in our calculations have used 8 cents as its cost.

Producer Gas.—I will not attempt to calculate the costs of all kinds of producer gases, but take the statements of the manufacturers as being correct, making due allowance for lack of efficiency, loss of by-products, etc.

R. D. Wood & Company, in their pamphlet on "Mond Gas," 1903, state that "The cost of Mond gas, when produced on a large scale, is less than 1 cent. per 1,000 cubic feet." In order to be safe, I have assumed that we could produce such gas at 3 cents per 1,000 cubic feet, and have taken its calorific value at 125 B.T.U. per cubic foot.

Steam Costs.—These are simply the costs as they exist in our boiler plant to-day. With the foregoing facts in mind, the following three tables show the installation cost and yearly expense of the 3-power system assumed:

Gas Engine Plant Using Uncarburetted Water Gas.	*First Cost.*
One 30,000 cubic feet relief holder	$5,000
Foundations, connections, scrubber, valves, etc	5,000
Building 40 by 100 by 25, at 7 cents per cubic foot	7,000
Two 500-horse power gas engines and foundations	40,000
Two 400 K.W.D.C. generators	7,000
Two 75 K.W. motor generators	3,400
Switchboard	6,000
Wiring	3,600
Small piping, air compressor and sundries	3,000
Two 200-horse power motors	4,500
Eight 75 " "	9,000
Three 50 " "	2,700
Small motors and pumps	2,300
Total	$98,500

=, say, $100,000. A certain operating expense for 1 year at the average load of 300 K.W. at switchboard.

Gas consumption efficiency = 13,000 B.T.U. per B.H.P. hour = 40 cubic feet per B.H.P. hour at 8 cents per 1,000.

Cost of gas, 400-horse power	$11,212.80
Oil, waste, packing, etc	2,000.00
Interest and depreciation at 10 per cent	10,000.00
Total	$23,212.80

and this equals 0.88 cents per K.W. hour generated. With an electric generator efficiency of 90 per cent. this figure becomes 0.90 cents.

In regard to labor, I will say that we can dispense with enough engineers to offset any additional men who would be required in the power plant, and thus no extra charge appears for this item. Right here I wish to call your attention to the method of estimating the costs above. It is absolutely necessary that you bear in mind that the figures are *comparative ones only*, not actual totals. For instance:

1. The certain operating expense does not include labor superintend-

ence, sundry expenses, etc., because these would be practically the same as for the present equipment.

2. I have figured interest at 5 per cent.

3. I estimate that depreciation for this kind of a plant should not be taken at less than 10 per cent. As it is impossible to arrive at the exact rate of depreciation and maintenance to allow on our present steam equipment, I have assumed that I can figure 5 per cent. depreciation on the *new plant*, and thus practically offset the lack of depreciation and maintenance charges against the old one. For this reason I have assumed interest and depreciation together at 10 per cent. These same arguments apply to the remainder of the figures in this paper.

Gas Engine Plant Using Producer Gas. First Cost.

One 500-horse power producer plant	$15,000
One 30,000 cubic feet relief holder	5,000
Foundations, piping, etc	5,000
Building 40 by 100 by 25, at 7 cents cubic foot	7,000
Two 500-horse power gas engines and foundations	40,000
Two 400 K.W.D.C. generators	7,000
Two 75 K.W. motor generators	3,400
Switchboard	6,000
Wiring	3,600
Small piping, air compressors and sundries	3,000
Two 200-horse power motors	4,500
Eight 75 " "	9,000
Three 50 " "	2,700
Small motors and pumps	2,300
Total	$113,500

=, say, $115,000. A certain operating expense for one year at the average load of 300 kw. at switchboard.

Gas consumption efficiency = 13,000 B.T.U. per B.H.P. hour = 104 cubic feet per B.H.P. hour at 3 cents per 1,000.

Cost of gas, 400-horse power	$10,932.48
Oil, waste, packing, etc	2,000,00
Interest and depreciation at 10 per cent	11,500.00
Total	$24,432.48

and this equals 0.93 cents per kw. hour generated. With an electric generator efficiency of 90 per cent., this figure becomes 0.95 cents.

In this, as in the foregoing case, we figure that the labor charges will offset each other. The producer plant is figured to be a Mond gas outfit, and includes piping, foundations, etc., but no holder or by-product apparatus.

Steam Engine Plant. First Cost.

Building, 40 by 80 by 25 at 7c. cubic foot	$5,600
Two horizontal cross-compound Corliss engines, 500-horse power, at $18 per horse power, generator direct connected	18,000
Two 400-kw. " D. C." generators (costs more than previous ones because of slower speeds)	10,000
Foundations and piping	8,000
Condensing apparatus	6,000
Cooling tower, complete	5,000
Two 75-kw. motor generators	3,400
Switchboard	6,000
Wiring	3,600
Two 200-horse power motors	4,500
Eight 75 " "	9,000
Three 50 " "	2,700
Small motors and pumps	2,300
Total	$84,100

=, say, $85,000. A certain operating expense for 1 year at the average load of 300 kw. at switchboard. The steam consumption was figured at 15½ pounds per B. H. P. hour at full load, and 20 per cent. more, or 18.6 pounds per B.H.P. hour at ¾ load. Adding 1.4 pounds for auxiliaries and condensation, we have 20 pounds total steam per B.H.P. hour.

Steam cost 400-horse power at 20 pounds per hour at 28 cents per 1,000 pounds	$19,622.40
Oil waste, packing, etc	2,000.00
Interest and depreciation at 10 per cent	8,500,00
Total	$30,122.40

and this equals 1.145 cents per kw. hour generated. With an electric generator efficiency of 90 per cent., this figure becomes 1.23 cents. The labor charges are treated as previously. The 28 cents per 1,000 pounds steam generated is our present boiler room cost.

From the foregoing figures it appears that we are safe in taking a kw. hour covering the items under consideration as costing 1 cent. additional, if gas engine power was used; and while the first cost of a gas engine plant is higher in our case than that of a steam plant, there is a considerable saving per year to be effected with it over the steam installation. Besides, our boiler plant has a maximum pressure capacity of 120 pounds per square inch, and as it operates on the water gas sets, considerable fluctuations in the steam pressure occur. No superheating surface exists at present and the boilers throw some water, which would materially affect the economy of a steam plant.

The gas engine has also other considerations for economy in that the all-day efficiency of the water gas plant might be brought up by using the first runs after clinkering and coaling up for an uncarburetted gas run for the gas engine, or if the carburetter is not up to heat by making several such runs. While a considerable number of experiments along these lines may be necessary, there certainly appears an opportunity here of using " poor water gas runs " to good advantage. Of course, the adoption of a producer plant would not allow this.

As regards the alleged unreliability of gas engines, I merely call your attention to the duplicate outfit proposed, and to the many thousands of horse power of such prime movers in successful daily operation in England and on the Continent, and ranging in size up to units of 2,000-horse power.

From the attached table, we have the following:

A certain cost per day, old steam system	$87.84
The comparative cost per day of electric power at 1 cent.	57.64
Saving per day	$30.20
Saving per year	11,023.00

To this must be added the saving we would effect by getting the current we now use at the gas works at the new rate as against the present rate. Yet we can scarcely call this a saving, because the present rate is an arbitrary figure between the two departments. It, therefore, appears that we should be able to save about $11,000 per year with the electric installation.

Thus, without considering interest on the present steam system, the electric driven plant with interest and depreciation pays for itself in from 8 to 10 years. It must also be noted that in the table the cost of operation of the present steam system is simply that of generating the steam, no account being made of supplies; and besides this, the maintenance of the long steam lines with their numerous valves, expansion joints, etc., requires considerable attention and repair.

Having adopted, as I believe, a reasonable estimate of first cost and cost of operation with the above considerations in addition, I submit to your judgment the fact that an economy in our power costs of over 30 per cent. may be obtained by operating this station electrically with a gas engine driven electric power plant.

For the collection of this data and the computing of the table, I am indebted to the efforts of Messrs. L. J. Ritschy and L. F. Musil, of our Station " A " force of engineers.

As a valuable adjunct to this paper I herewith append a report made by Mr. L. J. Ritschy, dated Sept. 14, 1904, showing the steam cost of pumping gas into our high pressure system, against gas pressures of from 1 to 5 pounds per square inch, both by our present steam method, and as it would be if the blowers were electrically driven with current at 1 cent per kilowatt hour. It is as follows:

ST. LOUIS, September 14, 1904.

Mr. W. A. Baehr, Engineer: Dear Sir—In conjunction with the tests for your paper regarding the economy of an electrically operated gas works, the following figures were obtained:

The test for the steam consumption of the No. 9 high pressure blowers and 12 by 14 engines was of 25½ hours' duration, besides condensing and measuring all the steam of one engine; the speed, or R.P.M., the indicated horse power and the pressures were observed, cards being taken at every change in speed. The second engine was kept running at about the same speed as nearly as possible, so that the amount of gas pumped by each engine was practically the same. This gives the following information from the station meter readings taken at the beginning and end of test:

Gas pumped per 24 hours	5,550,000 cubic feet.
Gas sent out to local low pressure system	2,162,000 "
Total gas made per 24 hours	7,712,000 "

While this result is an estimate to some extent, the slip of the blower being taken as 40 per cent., yet it is safe to say 2,000,000 cubic feet of gas are sent out daily into the local low pressure gas mains at this time of the year.

The steam cost of pumping 1,000 cubic feet at various pressures was found to be as follows:

Nature of Appliance.	Distance from Boilers. Feet.	Size of Machine.	Per Cent. of Total Time in Use.	Steam Used Per 24 Hours in Pounds.	Amount Pumped Per 24 Hours.	Steam Used per M. Cu. Ft. of Coal Gas Made.	Steam Used per M. Cu. Ft. of Water Gas Made.	Steam Used per M. Cu. Ft. of Mixed Gas Made.	Total Energy in Steam in B.T.U. Above 80 Degs. F.	Energy Delivered by Machine B.T.U.	Efficiency Per Cent. Ratio of two Preceding Columns.	Head Pumped Against. Pounds.	Cost of Steam per Day.	Total Motor Effic'y.	K. W. Hours per Day Required.	Cost of Electric Current at 1 cent K. W. Hour.
1. Simple ideal engine.	.....	Bl. No. 18														
2. Water gas exhauster.	230	Eng. 17×16	100	144,000	.....	.....	25.8	.....	164,160,000	*12,000,000	7.3	.9	$40.32	90	3,600	$36.00
	1–60	Ex. No. 9														
	1–125	S. 12×12	100	37,962	5,586,000 cu. ft.	.....	6.8	.....	43,277,000	719,000	1.66	.7	10.63	70	300	3.00
Rutger St. No. 1, coal gas exhauster	700	Ex. No. 8 S. 11×11	100	16,966	1,336,000 "	12.7	.....	.....	19,341,000	148,500	.77	.6	5.75	70	62	.62
Coal gas exhauster No. 2	90	Ex. No. 9 S. 12×12	100	5,609	790,000 "	7.1	.....	.....	6,394,000	88,000	1.38	.6	1.57	70	36	.36
High pressure blower No 1.	390	Bl. No. 9 S. 13×16	100	50,297	2,775,000 "	.....	.....	18.1	57,339,000	2,100,000	3.66	4.1	14.08	70	878	8.78
High pressure blower No. 2.	400	Bl. No. 9 S. 13×16	100	50,297	2,775,000 "	.....	.....	18.1	57,339,000	2,100,000	3.66	4.1	14.08	70	878	8.78
Boiler feed pump.	20	7 & 12×8×12	100	21,916	477,400 lbs.	.....	.....	2.9	24,984,000	172,000	.69	120.0	6.13	..	.....	.....
Tar pump.	.....	.....	.	280	2,800 gals.	.....	.06	.....	.....	.....	..	.....	.....	.....	.....	.....
	60	10×6×12	10	3,200	32,000 "	1.6	.....	.....	3,967,000	60,000	1.51	30.0	.98	..	.....	.....
Ammonia pump.	50	10×6×12	10	510	10,205 "	.24	.....	.....	581,400	3,830	.66	15.0	.15	60	2	.02
Water gas oil pump.	240	7×8×12	100	4,500	26,215 "	.....	.8	.....	5,130,000	17,450	.34	30.0	1.26	60	8	.08
Trap No. 1 (ideal engine room).	220	....	100	1,382	5,586,000	.....	.25	.....	1,575,000	0	.....	.....	.39	..	.....	.....
Trap No. 2 (new retort house)	650	.....	100	1,872	1,336,000	1.4	.....	.. ..	2,134,000	0	. ...	.....	.43	..	.....	.....
Trap No. 3 (high pressure engine room).	360	.....	100	779	7,712,000	.....	.....	.1	888,000	0	.....	.....	.22	..	.....	.....
Steam used in water gas generator.	50 to 200	.....	...	137,830	5,586,000	.....	.25	.....	.....	.....	. ...	.....	38.64	..	.....	.....
Total	.....	.....	...	477,400	.....	23.04	58.71	39.2	387,109,400	17,408,780	.....	.....	$144.63	..	5,764	$57.64

* This figure is not "energy delivered," but is actual work done in cylinder.

Table for use in conjunction with paper entitled "Distributing Power Throughout a Gas Works by Means of Electricity Generated at a Central Point."—W. A. Baehr, October, 1904.

I.H.P.	Gas Pressure in Lbs. per Sq. In.	R.P.M.	Steam Consumption by Card per I.H.P.	Steam Consumption by Test per I.H.P.	Steam per Revolution in Lbs.	Steam per Revolution per Lb. Gas Pressure.
39	3.4 lbs.	122	30.7 lbs.	.....	0.198	0.0582 lb.
46	3.7 "	132	30.6 "	.....	0.216	0.0584 "
53	4.1 "	139	31.0 "	37.2 lbs.	0.236	0.0576 "
64	4.7 "	141	30.0 "	.....	0.281	0.0598 "

Mean value, 0.0584 pounds.

The No. 9 blower has a displacement of 22 cubic feet per revolution, and at 40 per cent. slip this becomes 13.2 cubic feet per revolution actual capacity. With this assumption and the above data, the following costs were obtained, based on actual boiler room costs of 28 cents per 1,000 pounds steam.

The steam cost of pumping 1,000 cubic feet of gas against various pressures by the present steam engines, and also the cost using electric motors, is as shown below:

Gas Pressure in Pounds per Sq. Inch.	Steam per 1,000 Cubic Feet Gas Pumped.	Cost of Steam per 1,000 Cubic Feet Gas Pumped.	K.W. Hours Electric Power Required.	Electric Cost with Current at 1 Cent per K.W.H.
1 lb.	4.42 lbs.	$0.00124	0.0796	$0.0008
2 "	8.84 "	0.00248	0.1592	0.0016
3 "	13.26 "	0.00372	0.2388	0.0024
4 "	17.68 "	0.00496	0.3184	0.0032
5 "	22.10 "	0.00621	0.3980	0.0040

The kilowatt hours required are based on the tests and calculations of my previous report, *e. g.*, 50,000 pounds steam actually measured for these blowers is equal to 878 K.W. hours, assuming 10 per cent. loss of energy in the blower, and 20 per cent. loss in motor drive, motor and line loss; that is, 70 per cent. of the energy at the switchboard goes into the gas. This considers the motors driving the blowers by means of a silent chain.

This I believe will be valuable information for your Committee on "High Pressure Gas Distribution," and I have given Mr. von Maur, the Chairman, a copy of this report. Yours truly,

Lewis J. Ritschy, Asst. Supt., Station "A."

Youngstown, O., appears to favor the construction of a gas and electric plant to be operated on municipal account. So far, however, the matter seems neglected by the Committee of Council, in that the project has not been as actively taken up by the Committee as certain "prominent residents" would like.

[Continued from Page 606.]

PROCEEDINGS, TWELFTH ANNUAL MEETING MICHIGAN GAS ASSOCIATION.

Held in Jackson, Mich., Sept. 21 and 22, 1904.

First Day—Afternoon Session.

The President introduced Mr. V. F. Dewey, of Detroit, who read his paper entitled,

TEMPERATURE AS APPLIED TO THE PRODUCTION AND PURIFICATION OF COAL GAS.

[For the text of Mr. Dewey's paper see Journal, Oct. 10, page 563.]

Discussion.

Mr. Steinwedell—I read Mr. Dewey's paper and think we can all put a great deal of hard study on it, and while Mr. Dewey may not have drawn all the conclusions that might have been drawn from the data he has secured, I think he has presented it in such concise and efficient manner that all the points of value can be brought out in the discussion. The most important point perhaps is to find out from Mr. Dewey a few of the incidental operations from which he secured this data. For instance, I would like to ask whether he metered all of his gas through a small meter, whether he simply analyzed all of the ammonia from the coal, or whether he took the analysis from the gas at different intervals and computed the total ammonia and coal, and whether all these tests were taken as we take them in the works, or whether the gross amounts of ammonia were taken from tests at different intervals and then computed.

Mr. Dewey—Of course the ordinary way for testing ammonia is to have a small holder, and siphon the gas through the test bottles into these holders, thereby measuring the amount of gas as a sample, then computing the amount of gas and ammonia in the gas from the gas sample.

Mr. Steinwedell—In that way you do not take all of the gas, as I understand it. That is, you do not take the total ammonia from the gas, but you only take an average sample drawing a small portion of the gas at a time. For instance, for the first hour the sampler would be working continuously.

Mr. Dewey—We draw 1 or 2 cubic feet, as the case may be, which would be an average sample of gas made in that hour. Having the number of grains of ammonia in 1 or 2 cubic feet, and knowing the number of feet of gas made we can easily compute the amount of ammonia. I think this more correct than to attempt to take it from

the whole amount of gas—that is, to take ammonia from all the gas. Regarding the analysis of gas, we drew off an average sample as nearly as possible during the entire hour in each test arrangement, and then analyzed the gas. In that way we have got a very close average analysis of gas for that hour. Regarding the reliability of the meter, that, of course, is the whole thing. I explained the apparatus and how it was operated to testify to the reliability of that meter. The maintenance of constant pressure on the meter, the taking of the temperature and the meter reading, which was done every 5 minutes, were all controlled by one man, who kept the data right in his hands, so that the conditions of the test are uniform. Two other men took samples of gas.

Mr. Butterworth—Do I understand that that test was made from an average sample of gas made during the first hour, and not of the gas that was being made at the end of the first hour?

Mr. Dewey—Yes.

Mr. Butterworth—The conclusion Mr. Dewey arrived at shows that the amount of gas and ammonia produced is very small. How does it hold out regarding heat power?

Mr. Dewey—You can see from Chart No. 4, Mr. Butterworth, that the hydrogen ran as high as 60 and 70 per cent. Nearly all of the gas at the last hour was hydrogen, and 10 per cent. of the remainder was nitrogen, and necessarily the heat units would be under 300, and that as a commercial gas is absolutely out of the question. The per cent. of the total at the last hour is very small. Of course it is manifest we cannot stop at a 3-hour charge, as the retort is just getting itself into shape so as to get ready for the next charge. It might be possible for gas engineers who are manufacturing gas machinery to devise a method whereby to show the gas made the last hour could be separated from the richer gas as is done in the coke oven process.

Mr. Butterworth—Isn't it possible that the difference in the grade of coke might have something to do with it?

Mr. Dewey—I don't see any reason why the coke should improve it. Of course, going back into the coke question and the coke companies' process, we do know that they can make practically any grade of coke they wish by the way they manipulate the charge. For instance, if they want to make furnace coke they run a 30-hour charge. On the same heats if they want to make a domestic coke they run it 24 hours, with no higher heat, simply cutting the charge off.

Mr. Russell—I think we have a very valuable paper here. I have not had time to look over the tables, which carry most of the work. I do notice, however, that the work as done here is quite comparable, and the results correspond closely with those found in making gas in California from crude oil. If very high heats are carried in this process, much lampblack is obtained and the gas will run as high as 70 per cent. of hydrogen. If low heats are carried they get less lampblack, less hydrogen and less gas. The reason you get more gas with high heats is due to the greater percentage of hydrogen, and that being very light the gas volume increases. I notice, in Table No. 4, where the highest temperature is reached, a large percentage of hydrogen, which only goes to show that if we carry a very high temperature in the retorts, a large portion of the gas is made into hydrogen. What is given off the last hour, both as regards quality and quantity, depends on what heat you may be carrying and what condition your coke is in. The percentage of gas during the last hour may be high or low, depending upon the temperature of the retort and the time the charge has been made. It is pretty hard to say what heat ought to be carried.

Mr. White—I am very much interested in Mr. Dewey's paper, which seems to me one of the most valuable contributions ever made to American gas literature, because it was made up by people who can be trusted to make their work accurate. It brings out a number of points which are new to me and very interesting. For instance, this marked drop in the gas make, as shown in Chart 4. You will find at the end of 3 hours and 20 minutes the gas make falls off rapidly, the temperature curve at the top stops rising at that point. It looks as if as soon as it stops heating through the temperature would stop rising. This is true, at least in Charge No. 3, where the temperature keeps pretty nearly steady at 300°, and after 5 hours the gas make increases rapidly at that point. You will notice that No. 3 had a charge of 410 pounds and No. 4, 352 pounds, and the initial temperature of No. 4 was higher. The final temperature in the two cases is not very far apart—712 in No. 3 and 705 in No. 4. The effect of the increased charge seems that the coal has taken longer to heat through, and, therefore, had to heat it nearly 5 hours before gas is practically given off. In the other case, the gas is practically given off in 3½ hours. The only difference in effect is that it took longer to heat through, but did not affect the quality of the gas much. I notice in regard to ammonia that it drops off pretty rapidly at a point where the retort reaches its full temperature. I suppose the increase in nitrogen comes from the increased decomposition of ammonia. There is usually about 30 per cent. of nitrogen in gas, and we know, from experiments made at the University of Michigan, that tke decomposition of ammonia is very small, and increases pretty rapidly when it gets up to 700° to 800°, and I imagine that the increase is caused by the increased gas out of the hot retort.

Mr. Slater—I have had nothing like the time I would like to have had to digest this paper before discussing it, but this noon I read it over, and was very much surprised to see the results obtained, because a number of years ago I conducted similar experiments, although in a commercial rather than a scientific way. Charges No. 4 and 5, I think, correspond almost precisely with the results obtained in our experiments, which were carried on with 10 benches. Our object at that time was to determine the question of running 3-hour charges. We had been running 3-hour charges for a number of years, and quite a discussion came up. It was discussed in the American Gas Light Journal, and was later taken up by the *Journal of Gas Lighting*. We turned our lower station into an experimental plant, and the results Mr. Dewey obtained here are such as correspond with our experiences. I believe the results he has obtained and presented here form some of the best data we have. Charge No. 4 shows very strongly what our results were in determining our duration of charge. Our idea was to charge the retorts as heavily and as equally as we could, so as to determine the cost of carbonizing coal, both as to labor and quality of gas obtained as well as duration of benches, and our result was that we determined to stick to the same results obtained by Mr. Dewey. Our charge did not come so very high in fixed carbon, although it corresponds fairly well with the figures and productions given by Mr. Dewey. In regard to coke we find the longer the time of distilling the harder the coke, but as our market for coke was almost all domestic we did not require hard coke, so we were under no disadvantage, although the coke we got from 3-hour charges was considerably harder than we expected to get. Our method of operating was rather to maintain the action of furnaces as nearly uniform as possible, and to control the consumption of heat by the amount of the charge, when using a different kind of coal. We tried to keep the whole thing in uniform heat. I think Mr. Dewey's paper is an exceedingly valuable one.

Mr. Butterworth—About 6 months ago we had been experimenting between 3 and 4-hour charges, and I met an engineer shortly afterward who said he had been likewise experimenting. I asked him what results he found, and he replied that he got better results in England on 6-hour charges, but as he was an Englishman himself, he was trying to verify their position. We have been running 3-hour charges for about 18 years, to my knowledge.

Mr. Dewey—One thing I did not touch upon, but which will form one of the most interesting things that could possibly be taken up. It was mentioned in the meeting this morning that high candle power gas could be obtained by low heats and low candle power by low heats. I am not ready to subscribe to that opinion, and think there are others here who will agree, for the reason that we do know that we can have a large percentage of hydrocarbon, which is mostly ethylene, that has a comparatively low candle power relative to what it would be if this hydrocarbon were broken up and benzene obtained, and that is why I think it would be very interesting and make a good subject for investigation for a student at the University next year to take up, the subject of the effect high heat has upon candle power, and if possible to make a complete analysis of gas, determining the amount and kind of different hydrocarbons produced in retorting coal. In connection with this, I might quote something that I heard Mr. McMillin speak of in New York this spring that will be interesting. He said that while he had charge of the Columbus (O.) Gas Company at one time they reached a yield of 5½, and the strange thing about it was that as the yield went up the candle power went up, and Mr. Tippey had a like experience at Grand Rapids. Mr. Tippey was compelled to drop his investigation without obtaining absolute results, and this is something still open which would make a very valuable field for research.

Mr. Slater—In reference to the point Mr. Dewey has just brought out. You say that in experimenting with the 3 or 4 or 6-hour charge you found that with the same coal with the 3-hour charge if the manner of charging the retort were practically the same, the quantity and accumulation of gas did not materially vary, except the composition varied with the change in heats, but in running the 3-hour charge you got just as good a yield and candle power as when running the 4-hour charge.

Mr. Dewey—If we charged light, allowing the gas to come out slowly and remain longer in contact, it would be broken up and have less candle power.

Mr. Lloyd—I would like to know what was his experience in the matter of production of naphthaline in these various experiments; in these variations of heats and length of charges.

Mr. Slater—I have had all kinds of experiences. The actual results we found were that the heavier the charges an' the higher the heats the less naphthaline we had.

Mr. Russell—I think Mr. Slater's statement covers the whole thing. It is not so much the same temperature of the retort as the temperature the gas may attain. Anyone knows the gas passes off rapidly, and does not have time to attain the temperature in the retorts. No unusual decomposition takes place, so you may carry very high heats with short hour charges and still obtain a very high candle power. In this connection I notice one thing that seems to be somewhat contradictory to actual practice. In operation it is frequently necessary to suspend 4 or 5 or 6 benches, and we notice invariably in doing this, that for 4 to 6 hours after suspension of these benches, the charges being in from 10 to 12 hours, that during these 6 hours, after the benches are suspended there is almost no decrease in the yield of gas as shown by the meter. Now that would be in direct contradiction to this paper, but it perhaps can be explained by the fact that the heats are not high.

On motion a vote of thanks was passed to Mr. Dewey.

Then followed a dip into the Question Box, but as the initial discussion therein was not completed until the following day, it was thought best by the Secretary to print the questions and the debates thereon at the end of the proceedings.

SECOND DAY, MORNING SESSION.

The meeting was convened at 10:30 A.M. The President called for the paper by Messrs. Alfred H. White and S. Ball, on

THE FORMATION OF NAPHTHALINE IN COAL GAS.

[For the text of the paper see JOURNAL, Oct. 10 and 17, pp. 566, 604.]

Discussion.

Mr. Campbell—I do not think I can add anything to Mr. White's paper or to the results he reports, but I wish to express our appreciation of the men of the Michigan University for the support the Association has given us in its fellowship. While I have done very little of the work—it has practically all been done by Mr. White—the more we go into the subject the more there is to be done. Many questions are to be answered before we can get any accurate knowledge regarding naphthaline. The principal questions to be answered are such questions as the effect of the chemical composition of the coal on the quality of tar produced, and the amount of naphthaline given out with a given coal. The questions in time to be studied are the effects of temperature, and of time and rate of production of gas. These are points that will require a great deal of time, and perhaps might be better worked out at some of the works than could be done by the University, unless we should have a special little retort. I think the quality of tar, and its power of removing naphthaline, in connection with the proportion of naphthaline that is given off by coal, is one of the many things to be worked out and will take a great deal of time; but while I think Mr. White made a good start on this subject, I feel that it is not much more than a start. It is going to take a lot of time. The study of naphthaline is complicated. The further we go into it the more there is to be worked out. I believe Mr. White has made very good progress considering the time at his command.

Mr. Douglas—I might say in this connection that in conversation with Henry Hesse, of the Toledo Gas Company, he told me he had been having considerable trouble with naphthaline, but had been helped remarkably by cutting out the P. & A. tar extractor.

Mr. Lloyd—I felt for some time back that the work being done under the scholarship was of questionable utility, but after listening to this paper I feel in a mental condition to continue my subscription indefinitely. This class of work is of a kind which is in the minds of those who are thinking of a national association with a department of research. It may hardly be anticipated that ideal conditions can be always maintained in any works, even if such conditions could be said to be known, much less will they be possible in any average works operating under average conditions, yet the more severe of the difficulties in such works must be overcome. The University of Michigan, by its investigation of these practical conditions, by compiling and comparing the information so obtained, and by publishing its conclusions year by year in papers of the character of the one just read will gradually build up a text book of gas manufacture, at least as it applies to Michigan conditions, and such information, with the practical knowledge acquired by the University, cannot fail to be of the greatest practical value to the subscribers to this Scholarship Fund, who, by reason of their support, will feel at liberty in time of perplexing difficulties in their manufacture to call upon the skilled corps of the University for advice or assistance. And the University, by reason of the continuity of its work and the mass of information acquired under strictly practical and probably widely differing conditions, will be able to meet such cases on their merits, and in a manner wholly differing from the usual necessarily academical treatment which it can afford a subject.

Responding to a question, Mr White said—We have not enough data so that I would care to say how much naphthaline tar is capable of absorbing. We have not been able to find out how much naphthaline tar will hold at, say, 100°. It would be a very important point to determine. There is a patented system for scrubbing gas by a light tar at a somewhat high temperature, the temperature being chosen so as to take out the naphthaline, but not the illuminants.

Mr. Russell—I think there is no question but that we are all greatly interested in this paper. It is certainly the most important one ever gotten out by the Michigan Association's Scholarship. This paper with its experiments goes to show that the longer the Scholarship is continued the more valuable it becomes, because the University men are getting more and more in touch with the gas men of the State and what their needs are, and so when you talk about a certain piece of gas apparatus, the University men know what is meant. When I first started the Michigan Gas Fellowship work, neither the University Professors nor myself knew anything of the gas industry or the problems involved in gas manufacturing, and hence the practical result of the first year's work was almost nothing. The paper gotten out this year is the most valuable we have ever had. In connection with it, and as suggested by Mr. Lloyd's remarks, it seems to me that with a temperature of 110° or over, for a considerable length of time, naphthaline troubles can be lessened. In cases where the primary condenser works before the P. & A., I think there is less trouble, because the temperature in the primary condenser is usually about right to permit the tar to absorb the naphthaline without being so low as to endanger the candle power. In the Cincinnati works there is a long primary air condenser. The gas is in contact with the tar for about 600 feet travel, in 10-inch pipes, at a temperature not below 105° or 110°, and at these works they are having no trouble with naphthaline. I might mention an experience in steaming out pipes. Everyone knows how naphthaline is taken up at one place and deposited in another. A point to be taken into consideration, when testing for naphthaline at works where pipes have naphthaline in them, is to make sure that the gas being made at one time is the gas being tested, and not after it has had an opportunity to take up naphthaline from dirty mains.

Mr. Steinwedell—During the past 4 or 5 years Europe has changed much from our American methods, and the adopted system is to take the gas from the hydraulic main, run it through the primary condenser, then through the exhauster, and then through the naphthaline apparatus, which is covered with a heavy tar oil, then goes to the scrubbers, and then the final condensers and scrubbers, and while it is the aim of all gas companies to keep the gas in retorts, still in some cases the naphthaline has to be extracted, and has been done at a small expense, not exceeding ¼ of a cent per 1,000 feet of gas. They buy the dead oil preparation, and after it is saturated with naphthaline, is either sold back to the manufacturer of dead oil, or sold as tar. It depreciates the quality of tar, but the expense is light, and does way with naphthaline troubles.

Mr. Lynn—My experience with naphthaline has been that we find it first in one place and then another in the works, but I think there are some coals that will give us a great deal more trouble than others. In regard to the variations of temperature at the outlet of the gas in the hydraulic main, I do not know whether it would be feasible to take the gas from the hydraulic main. Regarding water in the mains, we do not know whether it is weak liquid or fresh water run in, and variations of temperature might be caused by running off or filling in. Our plan was to work the tar in the hydraulic mains, and that tar was run off with the liquids in that hydraulic main, then pass the gas through the hot scrubbers; the tar went into these scrubbers and the hot tar for about 480 feet through a 20-inch main. We have never varied the conditions of our plan very much, and always use about the same coal, yet we would be bothered with naphthaline in the summer season. Then it would disappear and we would probably not have any amount of it for a year, when it would come on in the cold season.

On motion a vote of thanks was passed to Messrs. White and Ball. On motion the meeting was adjourned to 2 P.M.

(To be Concluded.)

Exhibit of the Bristol Company at the St. Louis Exposition.

The display of recording instruments for pressure, temperature and electricity, made by the Bristol Company, Waterbury, Conn., is located in the Electricity Building. The accompanying illustration shows the

appearance of the booth, which is 22 feet long by 12 feet wide. The booth contains a large variety of recording instruments for pressure, temperature and electricity. These instruments record continuously, with ink upon graduated, revolving charts, all changes that occur in pressure, temperature or electricity, so that a record of a period of 24 hours or more may be observed at a glance. Many of these instruments are in actual operation, and may be inspected by visitors to show the manner of construction and scientific principles upon which their operation depends, and the extreme sensitiveness and accuracy that it is possible to obtain in instruments of this character without rendering them too delicate for commercial application. Recording pressure gauges are shown for ranges from full vacuum to 10,000 pounds per square inch; recording thermometers and pyrometers for ranges from 60° below zero to 1,200° F. The recording thermometers are made in many varieties of form to make them applicable to all industrial requirements, especially where it is desired to record temperatures at a distance from the source of heat. Recording volt, ampere and wattmeters, for both alternating and direct current, are shown, including a great variety of ranges suited to commercial demands for different voltages and currents in electric light, power and railway plants.

Recording water level gauges are shown in operation, and also a new instrument designated a thermometer-thermostat. This last instrument is so constructed that it may be used to give an alarm or set in operation temperature regulating apparatus at any predetermined point of temperature.

A full line of sizes of Bristol's patented steel belt lacing is also exhibited and includes styles and sizes of lacing for all varieties and thicknesses of belting.

The Care of Switchboards.

The *Electrical Review* truthfully says it is surprising to notice, in visits paid to central stations for the supply of electricity, evidences of the fact that, while systematic attention is devoted to the cleaning of the buildings and mechanical plant, and some little effort is made to keep the electrical running machinery in good order, very superficial notice is often taken of the condition of the switchboard. An instance of this came under our notice at a station whose switchboard was of the "flat-back" type. The marble front was beautifully clean, the glass and brass of the instruments were brilliant in their polish; but the engineer was unwise enough to show us the back of the board. A heavy coating of dust lay on the bus bars and cables, a mop and pail of water stood in one corner adjacent to a resistance frame, and balanced on the angle irons of the framework was an assemblage of pint pots, cups and parcels of food, this portion of the board being evidently reserved as a pantry by the switchboard attendants. This laxity is all the more astonishing because the board is the point of assemblage of all the power developed by the plant in the station prior to its departure to the feeding points of the system.

The reason for such neglect is probably that, with a continuous supply, the board is never entirely available for overhauling and cleaning. Parts which are in operation, or regarded as "spare," are exempted from strict examination owing to risk of life or other causes. The danger of this is, however, apparent to anyone who has had the opportunity of seeing what dust can do in increasing leakage and noticing the effect of loose connections in increasing the drop of volts in a bus bar.

A switchboard should be subjected to a detailed examination as often as, and of as severe a nature as that of the rest of the plant, which, although perhaps occupying more space, is, after all, only of the same power capacity of the board. This should be undertaken by the engineer in charge, and he should be particularly on the alert for loose connections. It is not a wise policy to wait until a screw drops out and an open circuit is formed before making an anxious investigation and a penitential report. A half-hour spent with a spanner and screwdriver, say, once a week, may save the credit of the station. It must be remembered that in a power house there is nearly always vibration constantly tending to jar connections loose. Alternate expansion and contraction of metal parts by heating as current is passed through them or interrupted aids vibration in making these parts work loose.

Dust in an engine room is usually rather oily, and where it touches it sticks. Moreover, parts charged to a potential differing from that of earth attract and retain light particles of dust. In some stations a small portable motor-driven air compressor is used in order to blow the dust off electric fittings, and the introduction of such appliances should not be discouraged. But it is not safe to rely on this method, partly because the general application of an air blast tends to diminish the detailed examination of the insulating part of the board by the attendant, and partly because oily dirt is not moved by a current of air. The blast should be followed by a careful wipe-over by an intelligent human being armed with a piece of dry, soft rag. Waste is not to be recommended, as it leaves fluff and loose strands lying about. In applying an air blast particular attention should be paid to resistance frames and other inaccessible parts. It is not desirable to have the pressure of the air higher than 60 pounds per square inch, as cases have come within our knowledge where mica insulation has been stripped away by too great a blast of air. Where it is impossible to draw links in order to make a certain part of the board "dead," a feather brush mounted on an insulating handle may be used on systems at ordinary pressures of supply.

On many boards oil-break fuses are used, which have an occasional trick on breaking of distributing their oil fairly impartially over the surrounding apparatus. Oil is in itself an insulator, and, therefore, although it looks untidy, it is safe. But a streak of oil is a resting place for all passing dirt, and if it is not soon removed the insulating properties of the board may be greatly reduced. On any board where oil is used, care must be taken that none gets upon insulation composed of rubber or wax, as they become deteriorated by its action.

It may not, perhaps, be out of place to draw attention at this point to the careful examination of fuses. Metal-strip fuses, it is notorious, deteriorate in course of time, and should be systematically replaced. A rough method of checking their behavior is to test their temperature when on full load. When a particular fuse has an unusually high temperature it should be marked for removal at the earliest possible opportunity. Quite apart from this, however, a fuse should not be allowed to remain in use for more than a year's running. Where oil-break fuses are used the level of the oil in them should be examined daily. Some types are constructed to break in air, the fused ends being then plunged in oil; other makers prefer to make the arc in the oil itself. In either case the oil must not get too low. Metal vapor bridges a very wide air space, and hideous results may follow from the improper breaking of a fuse.

It is an unfortunate phenomenon in central station practice that many parts of the plant, originally put up as temporary plant, become by their good conduct permanent institutions. This is very much the case with switchboards, where opportunities of reconstruction are rare. Teak—a very slow burning wood—has been used for this purpose. It is oily, and so resists moisture. It should, however, be watched with an anxious eye by the engineer in charge. Asbestos, from some points of view, is better—it will not burn. But it absorbs any moisture it can find and hence its insulating properties are diminished. If asbestos is used,

it should be painted with some insulating varnish to remove this danger. The same remark applies to slate, whose enamel has been damaged by an arc. Precautionary measures of this description are worth any amount of brilliant evolutionary operations with burning switchgear in order to save the lights.

One of the functions of the switchboard is to register the amount of energy generated and distributed. The switchboard attendant is supposed to take a record every quarter or half hour of his indicating meters, and to register the readings of his integrating meters at the end of his shift. If these meters are out of order, the proceedings become a solemn and arduous farce. The engineer should at least know how to adjust the zero of his indicators, and should do it. He should also check his machine meters against his feeder meters, one voltmeter against another, pretty frequently, and report faulty instruments. He should time his integrating instruments against his ammeters, and make sure there are no shunt current errors, friction losses, and so on.

It is, of course, impossible to enumerate all the points which require supervisory routine. Different types of switchboard develop various tendencies to failure, which have to be particularly watched. It is, however, safe to say that the engineer in charge will find that a conscientious scrutiny of his switchgear from time to time will amply repay him.

The Production of Natural Gas in 1903.

By "W. L. C.," in *Iron Age*.

The United States Geological Survey, in its forthcoming annual report upon the production and consumption of natural gas in 1903, sounds a note of warning to those manufacturers who employ this very efficient and comparatively cheap fuel in their plants. The statistics show that, owing to decreasing pressure in the natural gas fields, 881 establishments formerly supplied with this fuel were obliged to abandon its use during the past year. The most careful husbanding of resources, therefore, is earnestly urged, especially on the part of those manufacturers who have their own wells and who are, therefore, apt to underestimate the actual value of the fuel consumed or wasted.

Notwithstanding the decreasing pressure in several of the most important fields the production in 1903 was greater than in any previous year, being valued at $35,815,360, as compared with $30,867,863 in 1902. Four States, namely, Pennsylvania, West Virginia, Indiana and Ohio, produced 94 per cent. of the value of natural gas in 1903, and in the aggregate the United States produced 99½ per cent. of the world's production. There were 7,222 manufacturers and 627,047 domestic consumers who were supplied with light, heat and power during the year. A careful estimate puts the number of individuals benefited at not less than 4,500,000. A large amount of money was expended in 1903 in completing large mains for conveying natural gas, in equipping new compressing stations, and in drilling gas wells, mainly in Ohio, West Virginia, Pennsylvania and Kansas. The general average price received for the sale of natural gas in 1903 was very slightly greater than in 1902, being about 15 cents per 1,000 cubic feet at an average pressure of about 4 ounces per square inch.

It is only in recent years that natural gas producers have undertaken to put their business on a sound basis. One of the most successful appliances for economical use in the whole history of the industry is the gas meter, and its introduction has resulted in greatly increased revenues to the natural gas companies without seriously increasing the cost to the consumer, who is also interested in seeing that the gas is consumed in an economical manner. Stimulated by the success of more business-like methods and increased revenues, the natural gas companies have invested many millions in enlarging their capacity, extending their mains and acquiring additional gas territory. By far the most economical results have been secured by large gas engine compressors, in which natural gas is exploded instead of steam being used, and in which 9 cubic feet have developed 1-horse power per hour, while working at about 1,000-horse power capacity. Much larger pipe has recently been used in lines and the increase in diameter has added largely to their capacity and has increased the quantity of gas delivered at points of consumption. It is unfortunate that there is still a large quantity of natural gas wasted in southwestern Pennsylvania and West Virginia, where many of the upper gas-producing strata are pierced when drilling for petroleum stored in the underlying sands.

In 1903 the manufacturing establishments employing this fuel were distributed according to the table following.

A large proportion of the decrease of 881 in the number of establishments supplied in 1903 as compared with 1902 is accounted for by the decreasing pressure of the natural gas fields in Indiana. Compared with 1902 there was a decline of 2 steel works and 11 glass works in Indiana, a loss of 3 iron mills and a gain of 5 steel works and 7 glass works in Ohio, a loss of 3 iron mills and 6 glass works in West Virginia, besides other less important changes. The saving in the cost of fuel in 1903 by the use of natural gas in place of coal, wood, etc., is estimated at $9,224,429, or about 26 per cent. more than the value of the natural gas consumed.

States.	Iron Mills.	Steel Works.	Glass Works.	Other Establishments.
Pennsylvania	30	66	122	2,616
Ohio	5	14	63	1,704
Indiana	18	5	130	867
West Virginia	1	8	25	1,088
New York	None	None	5	203
Kansas	2	None	3	138
Kentucky	None	2	None	72
Other States	None	None	None	35
Totals	56	95	348	6,723

The natural gas engine has been extensively introduced throughout the gas belt. Its application was first made about 10 years ago, when it was used in pumping petroleum wells. Afterward, ranging from 5 to 1,000-horse power, it was extensively introduced into manufacturing, pumping and compressing plants, and it has successfully demonstrated its economy and reliability.

It is particularly applicable to the pumping of oil wells and to driving pipe line pumps, owing to the large number of points that are often widely separated and are difficult to supply with other fuel. The gas engine has in very many instances replaced the steam engine and boiler. In some instances this has been done by removing the steam engine entirely; in others by the substitution of a gas cylinder for a steam cylinder on the same engine bed. The dispensing with the troublesome boiler and the substitution of a much more economical engine have placed in the hands of the oil operator a much cheaper source of power, not subject to the contingencies of the former method, with a great saving of labor and material and also a great saving in the quantity of gas consumed.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Colonel Frank S. Richardson, whose management of the gas and electric lighting interests of North Adams (Mass.) and vicinity, has been beyond reproach for many years, some time ago announced that he was "about" to retire from active business cares. To show that he meant what he said we have merely to cite that less than a fortnight ago he was chosen President of the North Adams Trust Company, a concern which has in its membership a score or more of the best known business men and capitalists in beautiful Berkshire. Congressman George P. Lawrence is the Colonel's understudy in the Trust.

Mr. E. C. Hathaway, Vice-President and General Manager of the City Gas Company, of Norfolk, Va., forwards us an item showing that the output there in September this year exceeded that for September last year by 34 per cent., and that the relative increase in revenue for the like periods was 33 per cent. In further mention Mr. Hathaway says: "I am pleased to note that the illuminating and fuel increases are about equal. This has been one of the most successful seasons the Company ever had. A lot of new territory has been opened up, served by a high pressure system, which system by-the-way is eminently satisfactory."

Mr. Joseph M. Berkley informs us that the owners of the Union Gas and Electric Company, of Bloomington, Ills., have authorized an expenditure on generating and distributing plant that will call for the paying out of not less than $20,000. The betterments are now well underway and it is believed that all will have been completed before the winter season is on. The chief betterment to the distributing system is a 12-inch main from the works running about 1½ miles through the heart of the district. The laterals are of proportionate size. On the works a 12-inch Kerr Murray exhauster has been set up, also a P. & A. of like capacity. The purification system has been completely overhauled. The increase in the Company's business, so far as gas output is concerned, can be safely placed at 30 per cent.

The plant of the Meridian (Miss.) Company is to be greatly enlarged. The Messrs. Steiner at last seem to fully appreciate the possibility of profit that goes with gas sold in a business-like way.

A CORRESPONDENT in Washington, D. C., forwards the following: "Mr. Walter C. Allen, who has charge of the supply of electrical currents in the District of Columbia for various purposes, in his annual report to the Commissioners, proves that the showing for the year is very gratifying. One of the most important happenings was the great advance in the placing of electric conduits underground. The appropriation for the year on street lighting account was exceeded in the sum of 10 per cent., but the Superintendent believes that the expenditure on such score next year will not exceed that for 1903–04, which roughly stated was $215,000."

THE Pulaski Gas Light Company, of Little Rock, Ark., has completed a notable addition to its main system.

THE gas supply of West Allis, a thriving suburb of Milwaukee, Wis., s an accomplished fact.

A CORRESPONDENT in Boston, Mass., forwards the follawing: At the annual meeting of the Massachusetts Gas Companies, held in Boston some days ago, Messrs. Robert Winsor, Albert Strauss, C. Minot Weld, Charles A. Stone and Frederick E. Snow were re-elected trustees to serve two years, by a vote of 242,141 shares. The annual report of the trustees as submitted to the meeting, covering the operations for the fiscal year ending June 30, 1904, was accepted. The statement is of peculiar interest to the shareholders and the public generally just at this time. The comparison can be made with only 9 months of the preceding year, and this shows in the matter of revenue, dividends, expenses and surplus as below:

	1904.	*1903.
Interest received	$678,286	....
†Dividends received	594,031	....
Total	$1,272,317	$775,117
Expenses	20,257	10,721
Dividends	1,000,000	500,000
Surplus	252,060	244,396
Undivided earnings sub cos	84,618	734,764

*Nine months. †Included in this amount are 12 months' dividends of Massachusetts Pipe Line Gas Company, Brookline, Dorchester and Jamaica Plain Gas Light Companies, but only 6 months' dividends of the Bay State Gas Company, Boston, Roxbury and South Boston Gas Light Companies.

The above surplus of $252,060 represents approximately 1.3 per cent. on the $25,000,000 of common stock. The undivided earnings of the various Companies controlled by the big corporation are given as follows:

Massachusetts Pipe Line Company	$10,337
Brookline Gas Light Company	80,254
Dorchester Gas Light Company	52,037
Jamaica Plain Gas Light Company	15,074
Bay State Gas Company of Massachusetts	30,914
Boston Gas Light Company	68,980
Roxbury Gas Light Company	263
Total	$257,863
Less deficits:	
New England Gas and Coke Company	$171,532
South Boston Gas Light Company	1,713
Net undivided earnings	$84,618

The income account of the only subsidiary corporation not heretofore published is that of the New England Gas and Coke Company. This shows total revenue of $1,866,221, expenses of $1,524,527 and a total net income of $348,099. Deducting the general expenses, taxes and insurance, there was a balance of $233,245 left. Interest charges called for $404,777, leaving a deficit for the year of $171,532. The condensed balance sheet of the Massachusetts Gas Companies shows in comparison with the previous year as follows:

	1904.	1903.
Property account	$47,753,143	$47,696,568
Cash in banks	1,191,779	1,371,888
Notes receivable	1,280,000	1,680,000
Accounts receivable	61,291	95,941
Interest receivable	210,243	
Total assets	$50,496,456	$50,244,396
Preferred stock	25,000,000	25,000,000
Common stock	25,000,000	25,000,000
Accrued dividends	83,333	....
Profit and loss surplus	413,123	244,396
Total liabilities	$50,496,456	$50,244,396

President Weld makes no comments on the year's business. He gives the number of shares and bonds of subsidiary companies owned, and states that the trustees have arranged to purchase the stock of certain gas companies, the exact purchase price of which has not yet been finally ascertained.

MR. T. R. FRENCH incloses the following from West Chester, Pa., under date of the 17th inst.: "The Citizens Gas and Fuel Company, of Oxford, Pa., has been chartered by Governor Pennypacker. The necessary preliminary documents connected therewith were filed with the Recorder of Deeds for Chester County, by Mr. S. D. Ramsay as Counsel for the Company, the 12th inst. The declared purpose of the Company is manufacturing and supplying gas for light, heat and fuel to the public at the borough of Oxford, in the county of Chester, Pa., and to such persons, townships and corporations residing therein and adjacent thereto as may desire. Its place of business is in Oxford and the charter is perpetual. The capital stock is $20,000, divided into 200 shares of $100 each. The Directors chosen for the first year are David M. Taylor, James D. Burn and Clem B. McCormick, of Oxford; George D. Gitt, of Hanover, and H. H. Tindemuth, of York, Pa. James D. Burn is designated as Treasurer of the corporation. The other officers will be chosen from the Directors. With the charter on record the corporation will be ready for business."

THE final settlement respecting the changes in ownership of the Cheboygan (Mich.) Gas Company seems to have been reached. It is understood that control rests with certain capitalists of Grand Rapids, Mich., and it is said that the plant will be reconstructed. The officers are: President, F. A. Stowe; Treasurer, L. T. Wilmarth; Secretary, G. W. Rouse; Assistant Secretary, Ralph Child.

FAIRHAVEN, MASS., is said to be anxious for a gas plant. One of its foremost men, Mr. H. H. Rogers, should be able to put the authorities in the way of getting what they want or need in the gas line.

IN the year ended September 30th, the main system of the Peoples Gas Light and Coke Company, of Chicago, was increased by the placing of 66 miles of pipe, the average diameter of which was 4 inches.

THE following notice issued early this month by the proprieters of the Excelsior Coke and Gas Company, of Topeka, Kas., explains itself: "To Our Patrons: It gives us pleasure to announce that the rate of gas for all purposes has been reduced from $1.65 and $1.50 per 1,000 cubic feet to $1.25 per 1,000 cubic feet. This rate takes effect from October 1, 1904. However, all bills will be rendered at $1.25 per 1,000 cubic feet from the last meter reading in September, which gives the consumers the benefit of the reduced rate for a short time before the date of change. The Excelsior Coke and Gas Company has made this reduction with a view toward bringing gas into more general use for cooking and illuminating, and it is our hope that the low rate, together with the announcement of free connecting of gas ranges, and the liberal terms under which arc lamps for general lighting are installed, will enable our consumers to use a larger proportion of gas for fuel, light and power. The Company will continue to run from existing lines of mains free service pipes from mains to meter, whenever a bona fide consumer makes application for the use of gas. Bills for gas used will be presented promptly from the 1st to the 10th of each month, and to avoid the annoyance of collectors calling and to facilitate the transaction of business, we would suggest that bills be paid at the office of the Company, 435 Kansas avenue. This will be the means of bringing us into closer touch with our patrons, and enable us to learn in a more direct way how we can serve you better. Within a short time work will be commenced on the construction of an entirely new gas works, capable of supplying a city with a population of 200,000 people. It is the aim and desire of the management of this Company to give superior service, and upon the completion of the new plant we feel that Topeka gas consumers will enjoy service second to none in this country. We thank you for your patronage in the past, and assure you of our desire to render the best service possible."

IT is arranged that an electrical exposition is to be held in this city, the show, of course, to be brought off in Madison Square Garden. The exhibition is to run from December 19 to 28, and it is to be carried out under the direction of the Electrical Contractors' Association of this city. The moving spirit is Mr. J. R. Strong, of the named Association.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

THOS. J. CUNNINGHAM,
ELBERT P. CALLENDER,
EDITORS.

CHAS. E. SANDERSON,
MANAGER.

PUBLISHED ON EACH MONDAY OF THE YEAR AT
No. 42 Pine Street, New York.
Telephone, 2996 John.

TERMS:
SUBSCRIPTION—Three Dollars per annum, in advance. Single copies, 10 Cents.

The JOURNAL is the official organ of the
NEW ENGLAND ASSOCIATION OF GAS ENGINEERS.
AMERICAN GAS LIGHT ASSOCIATION.
WESTERN GAS ASSOCIATION.
OHIO GAS LIGHT ASSOCIATION.

NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:
New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, OCTOBER 24, 1904.

The Market for Gas Securities.

Last week in city gas shares was an interesting one, and traders for the long account had things all their way until this afternoon, when a slight set-back, undoubtedly due to realizing, was recorded. Since last time of reporting Consolidated sold well above 222, and the close to-day (Friday) was made at 218¼ to 218½. Those who are looking for an explanation of the advance are persistent in the assertion that the dividend rate is to be advanced to 10 per cent., but our opinion regarding the affair is that an amazing increase in business and the nearer approach of the time when the final changing over of the properties to a succeeding corporation are responsible for the appreciation.

Brooklyn Union sold as high as 229, and the closing to-day was reported at 226 to 228. One day this week the trading in the stock was about 1,000 shares, which means big activity for it. Consolidated, of Baltimore, remains a strong feature, the current quotation—82¼ to 83½—is the highest reported for a long time, and the end is not yet. Washington (D. C.) sold off a trifle in the week, but it is cheap at anything under 300.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

OCTOBER 24.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	218¼	218½
Central Union, Bonds, 5's.	3,000,000	1,000	106½	108½
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan	858,000	..	108	112
Mutual	3,500,000	100	270	300
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co.. Bonds, 5's	11,000,000	1,000	108¼	108¾
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	.
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	.	.
Northern Union, Bonds, 5's.	1,250,000	1,000	104½	106½
New York and East River.. Bonds 1st 5's	3,500,000	1,000	111	113
" 1st Con. 5's	1,500,000	..	106	108
Standard	5,000,000	100	125	130
Preferred	5,000,000	100	145	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	116	117
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	226	228
" " Bonds (5's)	15 000,000	1,000	113	115
Bay State	50,000,000	50	—	—
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	4	4¼
" " Bonds, 5's	5,250,000	1,000	12¾	.
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas and Electric Co	29,500,000	100	107¼	107½
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	97½	99
Columbus (O.) Gas Lt. & Heating Co	1,682,780	100	88¼	89½
Preferred	3,026,500	100	107½	109
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	83¾	83¼
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	89½	92
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co.	4,835,500	50	..	50
" Prior Lien 5's	5,603,000	1,000	99¼	100
Detroit Gas Co., 5's	382,000	1,000	75	75¼
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	35	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104¼	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	88	92
" Bonds, 5's	10,500,000	..	105¼	106
Indianapolis	2,000,000	..	65	68
" Bonds, 6's	2,650,000	..	107	109
Jackson Gas Co	250,000	50	82	.
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	35
Bonds, 1st 5's	3,823,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	.
Preferred	2,500,000	100	81	100
Bonds	10,000,000	1,000	109¼	110
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	138	140
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	107½	108¼
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co.	6,000,000	..	56	58
Bonds, 6's	4,000,000	..	105	105¾
New Haven	1,000,000	25	64	70
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	109	109½
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	.
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	15,800,000	100	58½	58¾
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	94	96
St. Paul Gas Light Co	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	113½	115
General Mortgage, 5's..	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	46	48
Bonds	2,047 000	1,000	94	96
Washington, D. C	2,000,000	20	296¾	299¾
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del.	600.000	50	230	..

Advertisers' Index.

GAS ENGINEERS.

	Page
A. E. Boardman, New York City	672
Baxter & Young, Detroit, Mich	672
B. E. Chollar, St. Louis, Mo	658
David Leavitt Hough, New York City	672
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	664
Frank D. Moses, Trenton, N. J	658
Frad. Bredel Co., Milwaukee, Wis	660
Frederic Egner, Washington, D. C	658
Geo. G. Ramsdell, New York City	658 659
Geo. R. Rowland, New York City	664
Humphreys & Glasgow, New York City	673
Isbell-Porter Co., Newark, N. J	674
J. Alex. Mayers, New York City	675
J. F. W. Jost, Philadelphia, Pa	661
Kerr Murray Mfg. Co., Fort Wayne, Ind	672
The Gas Machinery Co., Cleveland, O	660
The Jeffrey Manufacturing Co., Columbus, O	670
The Western Gas Construction Co., Fort Wayne, Ind	640
United Gas Improvement Co., Philadelphia, Pa	667

GAS WORKS APPARATUS AND CONSTRUCTION.

	Page
A. E. Boardman, New York City	672
Bartlett, Hayward & Co., Baltimore, Md	673
Baxter & Young, Detroit, Mich	672
Connelly Iron Sponge and Governor Co., New York City	660
Continental Iron Works, Brooklyn, N. Y	674
Cruse-Kemper Co., Philadelphia, Pa	660
Davis and Farnum Mfg. Co., Waltham, Mass	67
Deily & Fowler, Philadelphia, Pa	676
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	664
Frank D. Moses, Trenton, N. J	658
Fred. Bredel Co., Milwaukee, Wis	660
G. Shepard Page's Sons, New York City	672
Humphreys & Glasgow, New York City	672
Isbell-Porter Company, New York City	674
J. Alex. Mayers, New York City	675
Kerr Murray Mfg. Co., Fort Wayne, Ind	672
Lloyd Construction Co., Detroit, Mich	662
Logan Iron Works, Brooklyn, N. Y	673
Quintard Iron Works, New York City	673
R. D. Wood & Co., Philadelphia, Pa	674
Riter-Conley Mfg. Co., Pittsburg, Pa	675
Stacey Mfg. Co., Cincinnati, O	665
The Connersville Blower Company, Connersville, Ind	677
The Gas Machinery Co., Cleveland, O	660
The Jeffrey Manufacturing Co., Columbus, O	670
The Western Gas Construction Co., Fort Wayne, Ind	640
United Gas Improvement Co., Philadelphia, Pa	667

PROCESSES.

	Page
Bartlett, Hayward & Co., Baltimore, Md	673
B. E. Chollar, St. Louis, Mo	658
Economical Gas Apparatus Construct'n Co, Toronto, Ont.	664
Fred. Bredel Co., Milwaukee, Wis	660
Humphreys & Glasgow, New York City	673
The Gas Machinery Co., Cleveland, O	660
The Western Gas Construction Co., Fort Wayne, Ind	640
United Gas Improvement Co., Philadelphia, Pa	667

SCRUBBERS AND CONDENSERS.

	Page
Continental Iron Works, Brooklyn, N.Y	674
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	664
Fred. Bredel Co., Milwaukee, Wis	660
Isbell-Porter Co., Newark, N. J	674
Kerr Murray Mfg. Co., Fort Wayne, Ind	672
Logan Iron Works, Brooklyn, N. Y	676
R. D. Wood & Co., Philadelphia, Pa	674
Riter-Conley Mfg. Co., Pittsburg, Pa	675
Stacey Mfg. Co., Cincinnati, O	675
The Gas Machinery Co., Cleveland, O	660
The Western Gas Construction Co., Fort Wayne, Ind	640

PRODUCER POWER PLANTS.

	Page
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	664
R. D. Wood & Co., Philadelphia, Pa	674

TAR AND CARBONIC ACID EXTRACTOR.

	Page
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	664
Fred. Bredel Co., Milwaukee, Wis	660
Isbell-Porter Co.. Newark, N. J	674
Stacey Mfg. Co., Cincinnati, O	675
The Gas Machinery Co., Cleveland, O	660
The Western Gas Construction Co., Fort Wayne, Ind	640

AMMONIA CONCENTRATORS.

	Page
Fred. Bredel Co., Milwaukee, Wis	660
Michigan Ammonia Works, Detroit, Mich	655
The Gas Machinery Co., Cleveland, O	660
The Western Gas Construction Co., Fort Wayne, Ind	640

GAS METERS.

American Meter Co., New York and Philadelphia..... 679
Detroit Meter Company, Detroit, Mich..... 639
D. McDonald & Co., Albany, N.Y..... 677
Helme & McIlhenny, Philadelphia, Pa..... 679
John J. Griffin & Co., Philadelphia, Pa..... 680
Keystone Meter Co., Royersford, Pa..... 678
Maryland Meter and Mfg. Co., Baltimore, Md..... 678
Metric Metal Co., Erie, Pa..... 679
Nathaniel Tufts Meter Co., Boston, Mass..... 678

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia..... 679
D. McDonald & Co., Albany, N.Y..... 677
Helme & McIlhenny, Philadelphia, Pa..... 679
John J. Griffin & Co., Philadelphia, Pa..... 680
Keystone Meter Co., Royersford, Pa..... 678
Nathaniel Tufts Meter Co., Boston, Mass..... 678

PREPAYMENT METER ATTACHMENTS.

Reeves Mfg. Co., New Haven, Conn..... 679

GAS AND WATER PIPES.

Central Foundry Co., New York City..... 664
Charles Millar & Son Co., Utica, N. Y..... 664
Davis & Farnum Mfg. Co., Waltham, Mass..... 672
Donaldson Iron Co., Emaus, Pa..... 664
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 664
M. J. Drummond & Co., New York City..... 664
R. D. Wood & Co., Philadelphia, Pa..... 664
Warren Foundry and Machine Co., New York City..... 664

HYDRAULIC MOTORS.

American Hydraulic Motor Co., New York City..... 663

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila. 670
Perkins & Co., New York City..... 670
Westmoreland Coal Co., Philadelphia, Pa..... 671

SPECIALTIES FOR OIL AND PIPE LINES.

S. R. Dresser, Bradford, Pa..... 661

GAS MAIN STOPPERS.

Safety Gas Main Stopper Co., N.Y. City..... 664

MAIN AND SERVICE LAYING.

Sullivan Bros., Flushing, N. Y..... 616

GAS TAPPING MACHINES.

George Light, Dayton, O..... 664
H. Mueller Manufacturing Company, Decatur, Ills..... 662

CANNEL COALS.

Perkins & Co., New York City..... 670

STOKING MACHINERY.

G. A. Bronder, New York City..... 669

CONVEYORS.

Adam Weber Sons, New York City..... 668
C. W. Hunt Company, New York City..... 660
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 664
Fred. Bredel Co., Milwaukee, Wis..... 660
G. A. Bronder, New York City..... 669
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 672
The Brown Hoisting Machinery Co., Cleveland, O..... 671
The Gas Machinery Co., Cleveland, O..... 660
The Jeffrey Manufacturing Co., Columbus, O..... 670
The Link-Belt Engineering Co., Philadelphia, Pa..... 661
The Link-Belt Machinery Co., Chicago, Ills..... 664
The Western Gas Construction Co., Fort Wayne, Ind... 640

CHARGING BARROWS & COAL WAGONS.

Kerr Murray Mfg. Co., Fort Wayne, Ind..... 672
Stacey Mfg. Co., Cincinnati, O..... 675

GAS ENRICHERS.

Standard Oil Co., New York City..... 631
Sun Company, Pittsburg, Pa..... 671
The Sun Oil Co., Pittsburg, Pa..... 671

COKE CRUSHERS.

C. M. Keller, Columbus, Ind..... 671
Fred. Bredel Co., Milwaukee, Wis..... 660
The Jeffrey Manufacturing Co., Columbus, O..... 670

STEAM BLOWER FOR BURNING BREEZE.

The Connersville Blower Company, Connersville, Ind... 677

ECONOMIZERS.

Green Fuel Economizer Co., Matteawan, N.Y..... 676

GAS GAUGES.

The Bristol Co., Waterbury, Conn..... 664

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City 669
Fred. Bredel Co., Milwaukee, Wis..... 660
Isbell-Porter Co., Newark, N. J..... 674
R. D. Wood & Co., Philadelphia, Pa..... 674

CEMENTS.

C. L. Gerould, Bloomington, Ind..... 668

RETORTS AND FIREBRICKS.

Adam Weber Sons, New York City..... 668
Baltimore Retort and Firebrick Co., Baltimore, Md..... 668
Brooklyn Firebrick Works, Brooklyn, N. Y..... 668
Harbison-Walker Refractories Co., Pittsburg, Pa..... 666
Henry Maurer & Son, New York City..... 668
James Gardner, Jr., Co., Pittsburg, Pa..... 668
J. H. Gautier & Co., Jersey City, N. J..... 668
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 668
Missouri Firebrick Co., St. Louis, Mo..... 668
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 658
The Kreischer Brick Mfg. Co., New York City..... 668

INCLINED RETORTS.

Adam Weber Sons (Graham, Morton [England] System) 668
Fred. Bredel Co., Milwaukee, Wis..... 670
Geo. G. Ramsdell, New York City..... 658 659
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 658

VERTICAL S'S.

Adam Weber Sons (Oscar B. Weber's Construction)..... 668
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System) 669
Fred. Bredel Co., Milwaukee, Wis..... 660
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 658

VERTICAL RETORTS, CHARGING AND DISCHARGING VERTICALLY.

Adam Weber Sons, New York City..... 668

REGENERATIVE FURNACES.

Adam Weber Sons, New York City..... 668
Bartlett, Hayward & Co., Baltimore, Md..... 678
Fred. Bredel Co., Milwaukee, Wis..... 660
J. H. Gautier & Co., Jersey City, N. J..... 668
Laclede Firebrick Mfg. Co., St. Louis, Mo..... 668
Missouri Firebrick Co., St. Louis, Mo..... 668
Parker-Russell Mining and Mfg. Co., St. Louis, Mo..... 658

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N.Y..... 674
Fred. Bredel Co., Milwaukee, Wis..... 660
Isbell-Porter Co., Newark, N. J..... 674
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 672
Logan Iron Works, Brooklyn, N.Y..... 676
R. D. Wood & Co., Philadelphia, Pa..... 674
Stacey Mfg. Co., Cincinnati, O..... 675
The Gas Machinery Co., Cleveland, O..... 660
The Western Gas Construction Co., Fort Wayne, Ind.. 640

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City..... 668

INCANDESCENT GAS LAMPS.

Central Lighting Co., New York City..... 656
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 661
General Gas Light Co., Kalamazoo, Mich..... 659
Geo. G. Ramsdell, New York City..... 658 659
Knickerbocker Light and Heat Co., New York City..... 657
Welsbach Company, Gloucester, N. J..... 666

BURNERS.

Central Lighting Co., New York City..... 656
D. M. Steward Mfg. Co., Chattanooga, Tenn..... 661
Wm. M. Crane Co., New York City..... 661

LAVA GAS TIPS.

D. M. Steward Mfg. Co., Chattanooga, Tenn..... 661

STREET LAMPS.

Thos. T. W. Miner, New York City..... 660
Welsbach Street Lighting Co., New York and Phila.... 666

GAS FLASH SIGNS.

Qui-Vive Co., Grand Rapids, Mich..... 661

PURIFIERS.

Connelly Iron Sponge and Governor Co., New York City. 669
Fred. Bredel Co., Milwaukee, Wis..... 660
Isbell-Porter Co., Newark, N. J..... 674
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 672
R. D. Wood & Co., Philadelphia, Pa..... 674
Stacey Mfg. Co., Cincinnati, O..... 675
The Western Gas Construction Co., Fort Wayne, Ind... 640

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City 669

VALVES.

Continental Iron Works, Brooklyn, N. Y..... 674
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 664
Isbell-Porter Co., Newark, N. J..... 674
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 672
Ludlow Valve Manufacturing Co., Troy, N.Y..... 661
R. D. Wood & Co., Philadelphia, Pa..... 674
Stacey Mfg. Co., Cincinnati, O..... 675
The P. H. & F. M. Roots Co., Connersville, Ind..... 663
The Western Gas Construction Co., Fort Wayne, Ind.... 640

EXHAUSTERS.

Connelly Iron Sponge and Governor Co., New York City 669
Isbell-Porter Company, Newark, N. J..... 674
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 672
The Connersville Blower Company, Connersville, Ind... 677
The P. H. & F. M. Roots Co., Connersville, Ind..... 663

PURIFIER SCREENS.

John Cabot, Hoboken, N. J..... 660

GRATE BARS.

F. Ferguson & Son, Hoboken, N. J..... 664

GAS STOVES.

American Meter Co., New York and Philadelphia..... 679
Detroit Stove Works, Detroit and Chicago..... 678
Keystone Meter Co., Royersford, Pa..... 678
Maryland Meter and Manufacturing Co., Baltimore, Md. 678
Nathaniel Tufts Meter Co., Boston, Mass..... 678

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich..... 660

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N.Y..... 668

(*Continued on page* 656.)

POSITION DESIRED.

A man with fair technical education and 15 years' experience wishes an engagement with a gas or combined gas and electric undertaking in town of not less than 20,000 population. Is especially prepared to push a business to success that is not now doing what it should. Can furnish references. Address, "G. & E.,"

1533-2 Care this Journal.

DRAUCHTSMAN.

Young man, experienced on gas works, apparatus and machinery, desires a position.

Address, "BOX 809,"

1533-2 Care of this Journal.

WANTED,

By a small plant in a Southern city, a good, all-around gas man who thoroughly understands the manufacture and distribution of water gas. Good opening for the right man, who can show results. Address, stating experience, reference, and salary expected, C. F. GRANNIS,

1532-2 Bridgeport, Conn.

WANTED,

METER REPAIRER

Who can take charge of a meter repair shop and work at the bench. Must have experience in handling men. State age, salary wanted, and references. Address,

1532-2 "METER REPAIRER," care this Journal.

WANTED,

Second-hand Water Gas Machine.

Size, 6 feet to 7½ feet. Address, giving full particulars and price, "PURCHASER,"

1532-3 Care this Journal.

PROPOSALS FOR GASHOLDER.

OFFICE OF THE SUPERINTENDENT OF GAS WORKS,
RICHMOND, VA., October 11th, 1904.

Proposals will be received in Room No. 5, City Hall, up to 8 o'clock, P.M., November 1st, 1904, and then opened, for the construction of a four-lift gasholder of 2,000,000 cubic feet capacity, for the Richmond, Va., City Gas Works.

Plans and specifications may be had on application to Robert W. Hunt & Co., 66 Broadway, New York City, on payment of $10.

The Committee on Light reserves the right to reject any or all bids.

W. P. KNOWLES,
SUPERINTENDENT.

1532-2

NEW BUSINESS.

Gas Light Intensifier.

Capable business man who can invest $5,000 and upward can secure exclusive control of business monopoly in unoccupied territory. Yielding permanent income of over 50 per cent. yearly on every dollar invested. No risk. For particulars, address,

1528-tf "SUITE 710," 116 Nassau St., N. Y. City.

Utilize Your Gas Liquor.

NO EXTRA LABOR OR OPERATING EXPENSES.

IMPROVED AMMONIA CONCENTRATOR.

About 100 in use. Write to

STROH & OSIUS, Patentees, or
MICHIGAN AMMONIA WORKS, - Detroit, Mich.

(*Continued from page* 655.)

GASHOLDERS.

Bartlett, Hayward & Co., Baltimore, Md..... 673
Continental Iron Works, Brooklyn, N.Y..... 674
Cruse-Kemper Co., Philadelphia, Pa..... 663
Davis & Farnum Mfg. Co., Waltham, Mass..... 672
Deily & Fowler, Philadelphia, Pa..... 676
Economical Gas Apparatus Construct'n Co., Toronto, Ont. 664
Kerr Murray Mfg. Co., Fort Wayne, Ind..... 672
Logan Iron Works, Brooklyn, N.Y..... 676
R. D. Wood & Co., Philadelphia, Pa..... 674
Riter-Conley Mfg. Co., Pittsburg, Pa..... 675
Stacey Mfg. Co., Cincinnati, O..... 675

STORAGE TANKS.

Stacey Mfg. Co., Cincinnati, O..... 675

PAINTS.

National Paint Works, New York City..... 672

APTENTS, TRADE-MARKS, COPYRIGHTS.

Royal E. Burnham, Washington, D. C..... 669

BOOKS, ETC.

Scientific Books..... 617
Newbigging's Handbook for Gas Engineers & Managers. 616
Practical Handbook on Gas Engines..... 656
Self-Instruction for Students in Gas Manufacture..... 670
Electric Gas Lighting..... 670
Coal Tar and Ammonia..... 670
Field's Analysis, 1903..... 681
Directory of Gas Companies..... 675
Gas Engineer's Laboratory Handbook..... 674
Poole on Fuels..... 671
Binders..... 671
Practical Photometry..... 669

HARBISON-WALKER REFRACTORIES COMPANY,

Farmers Bank Building, Pittsburg, Pa.

REPRESENTING

HARBISON-WALKER CO.
PHILIPSBURG FIREBRICK CO.
CLEARFIELD FIREBRICK CO.
BASIC BRICK COMPANY,
CLINTON COUNTY F. B. CO.
FREDERICKS MUNRO CO.
WALLACETON FIREBRICK CO.

MANUFACTURERS OF

HIGH GRADE FIREBRICK

For Gas Plant Construction,

Chrome, Magnesia, and Silica Brick,

Ground Fireclay, Silica Cement, Dead Burned Magnesia and Chrome Ore.

We Carry in stock constantly at our various works a complete line of shapes in the following well-known brands:

BENEZET. CLEARFIELD. MUNRO. "W. F. B."
WOODLAND, WIGTON STEEL, EUREKA, CORNING.
H. & W. SPECIAL, WALLACE, TYRONE, CLINTON.

For use in every line of work in which refractory Material is required.

Catalogues will be furnished upon application. - - - Correspondence and trial orders solicited.

(In writing, kindly mention this Journal.)

The "Air-Light"

Premier Burner Of America.

Genuine "Air-Lights,"

A New Burner for 1905.

Increased in Value. Decreased in Selling Price.
Write for Trade Discounts.

Correspondence from Gas Companies Specially Solicited, as Air-Lights increase the number of gas consumers.

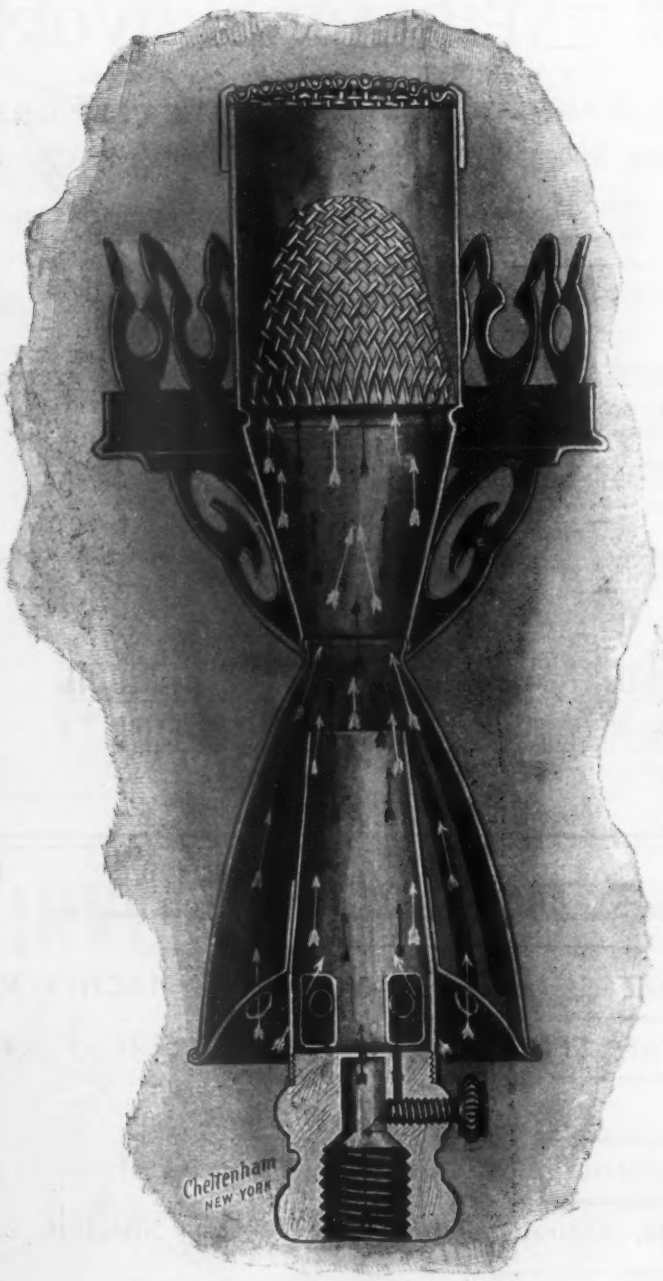
DENAYROUZE TRADE MARK AIR LIGHT REGISTERED PAT. 673,705 MAY 7 1901

Central Lighting Co., 86 Warren Street, New York.

PRACTICAL HANDBOOK ON GAS ENGINES, WITH INSTRUCTIONS FOR CARE AND WORKING OF THE SAME,

By G. LIECKFELD, C.E. Translated with Permission of the Author, by GEO. M. RICHMOND, M.E. Price, $1.00.

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.



WHITE ARROWS SHOW AIR
BLACK ARROWS GAS

WHY?

WRITE
FOR
A
BOOKLET
TO-DAY

YOU WILL THANK US
FOR THE SUGGESTION

LOOK AT THE PICTURE

Knickerbocker Light & Heat Co.

25 West Broadway New York

PARKER-RUSSELL MINING AND MFG. CO.,

OF ST. LOUIS, MO.,

PROPRIETORS OF THE

OAK HILL GAS RETORT AND FIREBRICK WORKS.

ST. LOUIS OFFICE: 417 Pine Street. NEW YORK OFFICE: Aldrich Court, 45 Broadway.

WE MAKE A SPECIALTY OF WATER GAS LININGS AND CHECKER BRICK.

Half and Full Depth Benches of Our Own Design, Containing 6, 8 or 9 Retorts.

SLOPERS.--We have perfected plans of INCLINED RETORT BENCHES, designed to meet conditions prevailing in America, and constructed entirely of American materials.

We Build Benches Complete. Ready for Gas Making. Also,

RETORT HOUSES,

COAL and COKE CONVEYING MACHINERY.

Plans, Specifications and Estimates Cheerfully Furnished.

CORRESPONDENCE SOLICITED.

ALL CONTRACTS MADE AS OF ST. LOUIS, MO.

FREDERIC EGNER,

Gas Engineer,

NORFOLK, VA.,

May be consulted with reference to estimates of cost for new, or appraising actual value of existing works; utility of proposed or patented processes; relative earning power to capitalization, and management.

Chollar's System of Gas Purification.

THE PURIFIED GAS REVIVES THE FOULED OXIDE

GEO. G. RAMSDELL.

DRAKE'S SYSTEM OF INCLINED RETORTS. COAL AND COKE MACHINERY.

P. H. & F. M. ROOTS CO. GAS EXHAUSTERS, HIGH OR LOW PRESSURE.

AMMONIA CONCENTRATING PLANT.

AIR DEVICE for Admitting a Proper Percentage of Air into Purifying Boxes.

Governors, Gas Valves, Cast Iron Specials, Gauges, Photometers, Gas Specialties.

TELEPHONE, 3553 Spring. **530 BROADWAY, NEW YORK CITY.**

FRANK D. MOSES,

Long Distance Telephone, 1922, Trenton, N. J.

TRENTON, N. J.,

Long Distance Telephone, 1922 Trenton, N. J.

Constructing Engineer and Contractor.

Estimates Furnished on any kind of Work in Connection with Gas or Water Plants.

SPECIAL ATTENTION GIVEN TO THE REMODELLING AND EXTENDING OF THE PROPERTIES OF WORKS NOT UP-TO-DATE

CORRESPONDENCE SOLICITED.

A Beautiful Pair.

HUMPHREY FANCY ARCS.

Ornamental Arc.

THE only distinctly new design of Gas Arc produced since the original Humphrey gave its powerful impetus to Commercial Gas Lighting and inaugurated a new business era. Our new lamps broaden the field.

GENERAL GAS LIGHT CO.,

Factory: KALAMAZOO, MICH.

NEW YORK. SAN FRANCISCO. LONDON. BREMEN.

Residence Lamp.

INVERTED INCANDESCENT GAS LAMPS.

No. 1 Lamp Complete, with Ground or Clear Globe and Mantle, $2.50.

These Burners are the most attractive Light on the market today. Over 20 candles of light per foot of Gas.

Especially susceptible to artistic effects and readily attached to existing fixtures.

Absolutely Shadowless,
Graceful in Appearance,
Efficient in Operation,
Exceedingly Simple.

No. 2 Lamp Complete, with Ground or Clear Globe and Mantle, $2.25.

THE BIJOU LAMPS

Bijou Lamps Complete, with Ground or Clear Globe and Mantle, $2.00.

Are the nearest approach to Electric Light, and are particularly effective for private house lighting, consuming but 1 foot of gas per hour, giving over 20 candles of light. Beautiful effects produced by the use of Artistic Globes.

Bijou No. 3, Complete, with Ground or Clear Globe and Mantle, $1.80.

Absolutely Shadowless,
Particularly Effective
In Clusters.

Superior to Electric Light at One-eighth to One-tenth the Cost.

DISCOUNT TO THE TRADE.

THE NEW INVERTED INCANDESCENT GAS LAMP CO., LTD.,

GEO. G. RAMSDELL, Agent,

530 BROADWAY, - - NEW YORK CITY.

P. PLANTINGA PRES. THE W.E. STEINWEDELL SEC.

GAS-MACHINERY

— CO., —

MAIN OFFICE AND SHOPS

CLEVELAND, O.

N.Y. OFFICE 44 BROAD ST

J.A MAYERS
REPRESENTATIVE

COAL & WATER GAS
APPARATUS,
PURIFIERS, VALVES,
CONNECTIONS,
ROTARY SCRUBBERS,
WASHERS,
BY PRODUCT MACHINERY.
COMPLETE GAS PLANTS.

PATENTS, TRADE MARKS, COPYRIGHTS.

ROYAL E. BURNHAM,

Solicitor of Patents and Counsellor in Patent Causes.

833 Bond Building, Washington, D. C.

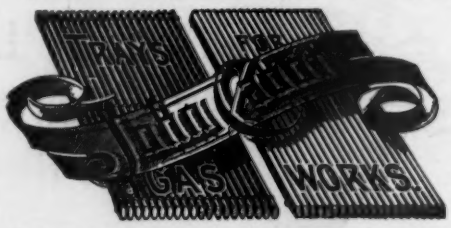
Send for Pamphlet on Patents.

1418-tf

Church's Patent Trays.

Reversible; Strongest; Most Easily Repaired.

Special Trays for Iron Sponge.



1412-1416 Adams Street, Hoboken, N. J.

We also Supply the Chapest and Strongest

•Reversible Bolted Trays•

IN THE MARKET.

SEND FOR BOOKLET AND CIRCULARS.

"THE MINER"

Globe

Street and Boulevard

Lamps.

Cheapest and Best

THOUSANDS IN USE WITH INCANDESCENT BURNERS.

Send for Catalogues.

THOMAS T. W. MINER,

821-823 Eagle Av., N.Y.

C. W. HUNT COMPANY

SOLE MANUFACTURERS OF "INDUSTRIAL" RAILWAY. CARS, TRACK, SWITCHES, TURNTABLES, ETC. IN STOCK FOR IMMEDIATE SHIPMENT.

NEW YORK CITY.

This is No. 2.

Height, 36 inches.
Diameter, 12 "
Shipping weight, 80 lbs.
Net weight, 50 lbs.
The products of combustion are entirely separate from the water. Entire water surfaces are tinned.

Price, $35.00.

HOT WATER

FOR BATHROOM AND KITCHEN

is most easily, quickly and economically supplied by a

Humphrey Crescent Instantaneous Water Heater.

Prices range from $20 to $45.
Every Heater GUARANTEED.

Set a heater for every gas consumer. You will please them and increase sale of gas at the same time.

Send to-day for catalogue and discounts to

HUMPHREY CO.,

Kalamazoo, Mich.,

The only manufacturers in the World of a COMPLETE LINE OF INSTANTANEOUS WATER HEATERS.

Gas Analyses of All Sorts and Conditions,

—OR—

Analyses of Solid and Liquid Materials as Well,

That are needed by Gas Companies at any time in the conduct of their business, may be obtained from

DR. W. H. BIRCHMORE,

1421-tf 341 ADELPHI ST., BROOKLYN, N. Y.

FRED. BREDEL, President. WM. O. VILTER, Vice-President. O. W. GREENSLADE, Secretary and Treasurer.

FRED. BREDEL COMPANY,

ENGINEERS AND BUILDERS OF GAS PLANTS.

Inclined Benches, own system, Recuperative Furnaces, Exhausters, Exhauster Governors, Condensers, Washers, Coolers, Wet Purifying Plants, Purifiers, Oxide Elevators, Hydraulic and Dry Coke Conveyors.

Special High Grade Material for Recuperative Furnaces.

Licensees for ARROLL-FOULIS Charging and Discharging Machines and FRONHAUSER Coke Conveyors. OFFICE, 405 KEENE ST., MILWAUKEE, WIS

BRAY BURNERS

Are Used Everywhere,

Because they are the best.
Reliable absolutely.
Accurately marked.
You can't find a city in the world,
with gas, not using them.

All Bray Burners are stamped with Name and Trade Mark.
Refuse Imitations. Send for Blue Book.

WILLIAM M. CRANE COMPANY,

1131 & 1133 Broadway, New York City.

THE

Ludlow Valve Mfg. Co.,

TROY, N. Y., U. S. A.

Double and Single Gate Valves, ¼" to 72",

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.

COAL-CRUSHING, ELEVATING AND CONVEYING MACHINERY,

Installed 1903 for Empire Coke Co., Geneva, N. Y.

Machinery consists of steel track hopper, 35' centers overlapping pan apron feeder, 3-roll coal crusher and 112' centers continuous bucket inclined elevator. The machinery handles run-of-mine bituminous coal at rate of 45 tons per hour.

Link-Belt circulars (descriptive of many types of coal-handling methods) free on request of interested persons.

LINK-BELT ENGINEERING CO., Philadelphia.

NEW YORK: 49 Dey St. PITTSBURG: Park Bldg.
CHICAGO: Link-Belt Machinery Co.

THE SAME EFFECT

as electric flash signs, but at a fraction of first cost and of cost of maintenance. THE QUI-VIVE GAS FLASHER. Hadn't you better get posted?

THE QUI-VIVE CO.,

153 Canal St., Grand Rapids, Mich.

FIELD'S ANALYSIS FOR THE YEAR 1903.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 35th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by

A. M. CALLENDER & CO., 42 Pine St., New York City.

J. F. W. JOST,

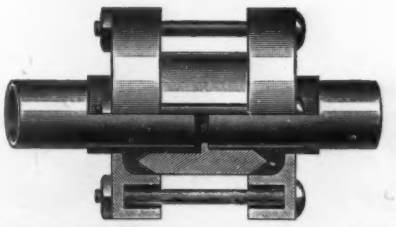
CHEMICAL ENGINEER
—IN—
GAS MANUFACTURE,

P. O. BOX 2043, PHILADELPHIA, PA.

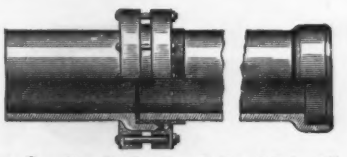
S. R. DRESSER,

BRADFORD, PENNSYLVANIA, U. S. A.,

Patentee and Manufacturer of Specialties for Oil and Gas Lines.

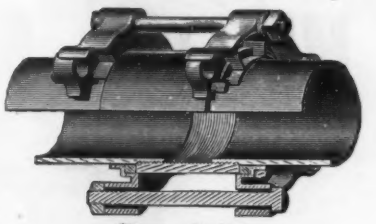


Insulating Coupling for Wrought Iron Pipe. Style 8.

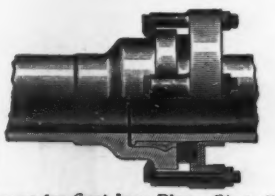


Insulating Coupling for Dresser Bell and Spigot Cast Iron Pipe. Style 6.

Regular Sleeve. Style 2.



Clamp. Style 4.



Clamps for Cast Iron Pipe. Style 4½.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

WHAT A PLEASURE IT IS!

To *please* your consumers. What *pleases* them *pleases* you. Steward Burners *please* everybody. Won't you *please* give us the pleasure of *pleasing* your consumers. *Please* do.

D. M. STEWARD MFG. CO., Est. 1876, CHATTANOOGA, TENN.

LLOYD CONSTRUCTION COMPANY,
DETROIT, MICH.

GAS WORKS BUILDERS.

MUELLER GAS MAIN TAPPING MACHINES.

COMBINATION MACHINE.

C—1002.

With some gas plants the amount of tapping, either open or under pressure, is hardly enough to justify the purchase of a machine for each, in which event a medium priced machine to do both well would meet the requirements.

The Mueller Combination Machine is medium priced and fully meets the requirements of such conditions. It can be used to make open taps, and with the gas cylinder attached makes taps under pressure as well.

Mueller Tapping Machines are made in seven styles and for all kinds of service and open tapping. The machine illustrated makes taps under pressure from ⅝ to 2 inch, and open taps up to 3-inch.

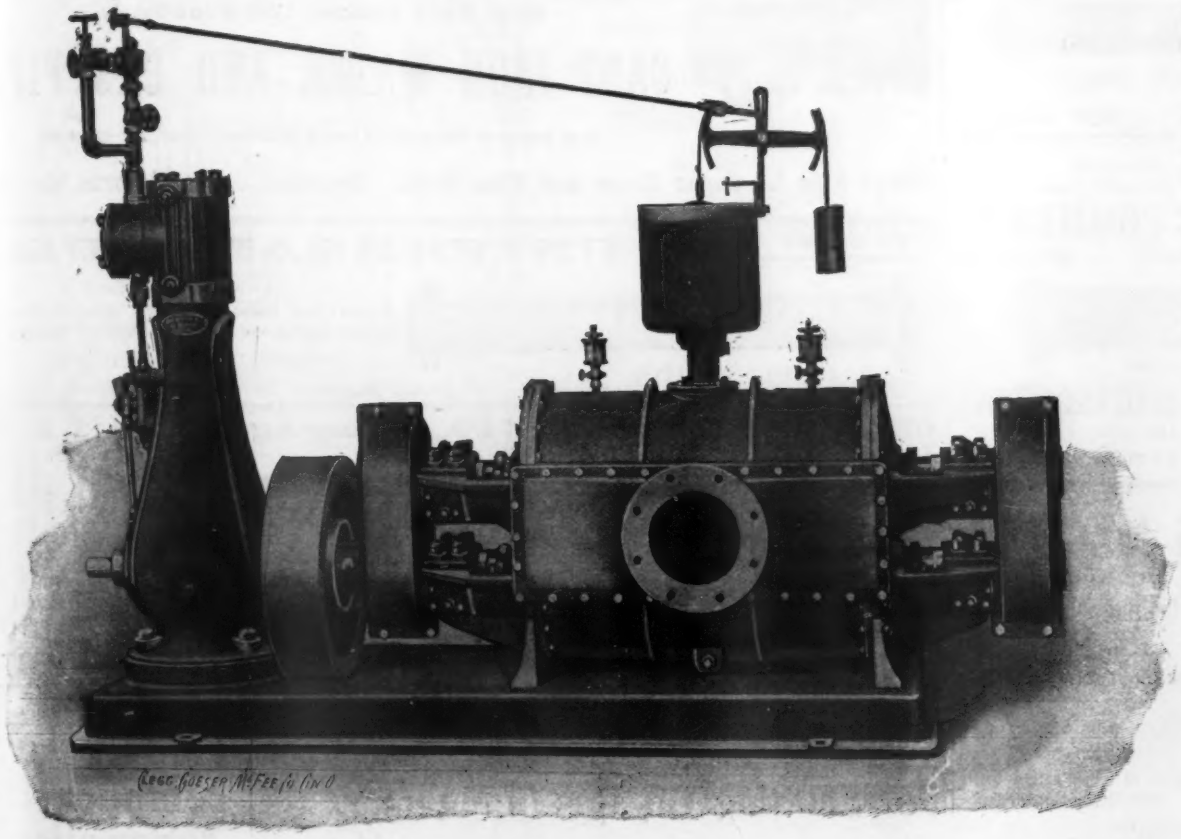
Each machine is carefully inspected and assembled, is given a working test as near like actual service use as possible, bears the Mueller trade mark, and is *unconditionally guaranteed.*

We also make meter connections and ground key work for gas works' use. Catalogues upon application.

Mueller Gas Main Tapping Machines are on exhibit in the Palace of Manufactures, World's Fair.

H. MUELLER MFG. CO.,
DECATUR, ILL., U. S. A.

ROOTS' GAS EXHAUSTERS.



Sizes for any required capacity.

Self-oiling, adjustable bronze bearings.

Most perfect and sensitive Governor.

Write for Catalogue.

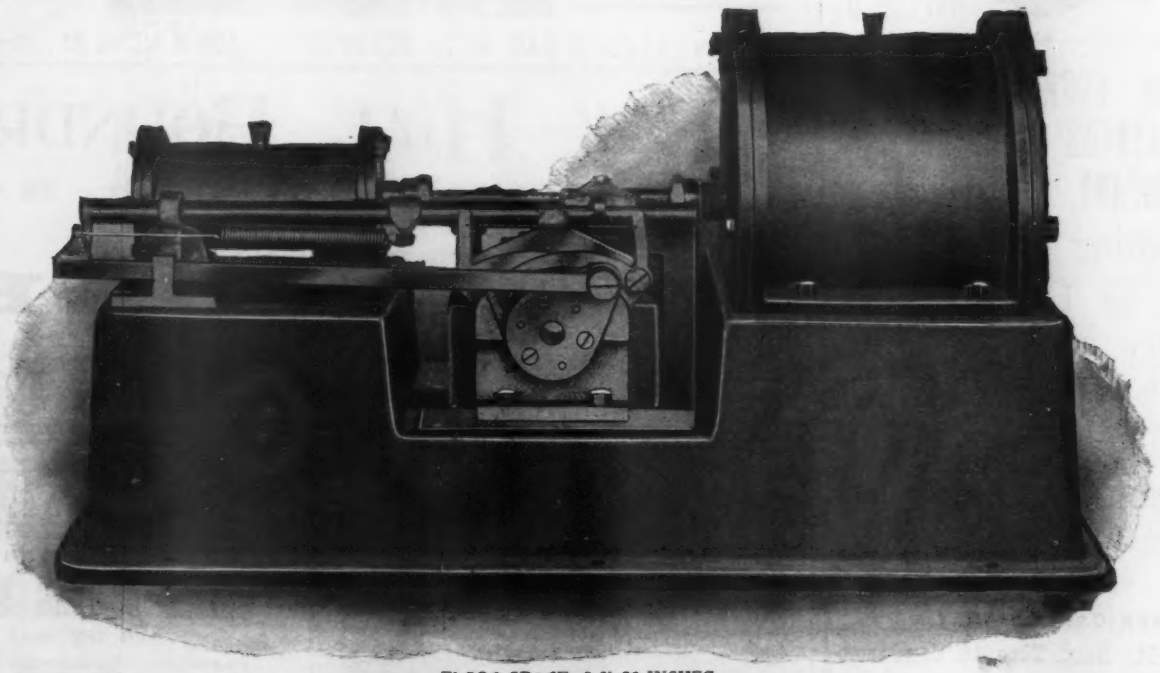
P. H. & F. M. ROOTS COMPANY,

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty St.

CHICAGO OFFICE:
1547 Marquette Bldg.

COMPTON GAS PRESSURE BOOSTER.



FLOOR SPACE, 9 X 23 INCHES.

An automatic gas booster that increases the lighting power of mantle burners over 500 per cent. Obviates the necessity and expense of high pressure gas mains. Booklet, telling all about it, for the asking, mailed free.

AMERICAN HYDRAULIC MOTOR COMPANY,

116 NASSAU STREET, NEW YORK

M. J. DRUMMOND & CO.
MANUFACTURERS OF
CAST IRON
FLANGE
GAS AND WATER PIPE

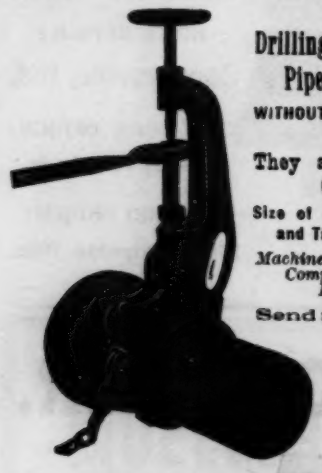
GENERAL SALES OFFICE:
182 BROADWAY, - - - NEW YORK.

GEORGE ORMROD, Mangr. & Treas., Emaus, Pa.
JOHN DONALDSON, Prest., Betz Bldg., Phila., Pa.

EMAUS PIPE FOUNDRY.
DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF
CAST IRON PIPE AND SPECIAL CASTINGS
FOR WATER AND GAS.
Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES
—FOR—
Drilling and Tapping Pipe under Pressure
WITHOUT ANY ESCAPE OF GAS.
They are Strong and Compact.
Size of Combination Drills and Taps ¾ to 4-inch.
Machines Sent to any Gas Company for Thirty Days' Trial.
Send for Circulars.

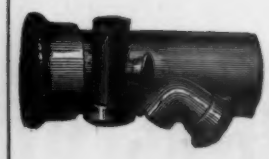


Geo. Light,
DAYTON, O.

THE ECONOMICAL
GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,
Consulting Engineers.
Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::
PLANS,
SPECIFICATIONS
AND ESTIMATES
PREPARED.
AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.,
Established 1856. Works at Phillipsburgh, N. J.
New York Office, 160 Broadway.



CAST IRON WATER AND GAS PIPE,
FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF
Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

NO LEAKY JOINTS IN UNIVERSAL PIPE.

Specially adaptable for—
High and Low Pressure Gas Mains.
High and Low Pressure Water Mains.
WRITE FOR PRICES.
CENTRAL FOUNDRY COMPANY - - - 116 Nassau Street. New York City.

CHARLES MILLAR & SON CO., Selling Agents, Utica, N.Y.
Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.
UTICA PIPE FOUNDRY CO.
Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers' and Tinners' Goods.
CAST IRON PIPE and SPECIALS FOR WATER AND GAS
Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

SAFETY GAS MAIN STOPPER COMPANY,
For Shutting Off Gas in Mains
Temporarily during alterations and repairs. : : : :
Any size gas main can be shut off in 30 seconds. : : :

STOPPERS SENT ON TRIAL.
Address: SAFETY GAS MAIN STOPPER CO., 108 E. 117th St., New York City.

FOX HILL FOUNDRY,
F. FERGUSON & SON,
HOBOKEN, N. J.
FINE OPENING
GRATE BARS
FOR GAS WORKS.
STATIONARY, SHAKING, DUMPING.
BARS FOR HAZELTON BOILERS.

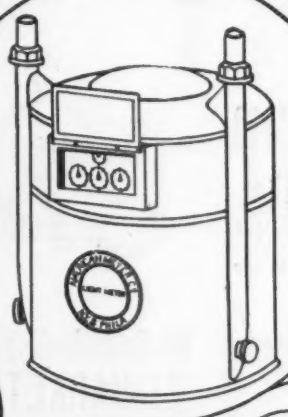
BELT CONVEYORS
EQUIPPED WITH
BALL BEARING ROLLS
ARE THE BEST,
because they possess greater efficiency, consume less power, and the belts last longer than when any other type of roll is employed.
PLANS AND ESTIMATES FURNISHED ON REQUEST.
The Link-Belt Machinery Co.
Link-Belt Engineering Co.
Philadelphia Chicago, U.S.A.

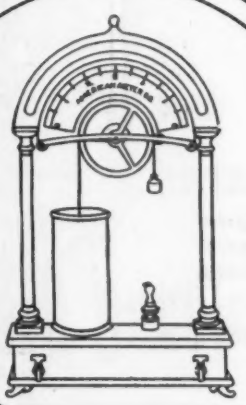
(Copyrighted, 1894, by the AMERICAN METER CO.)

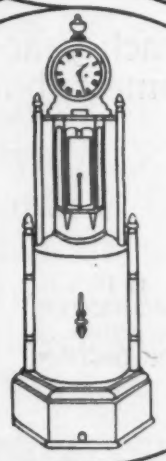
AMERICAN METER CO.

ESTABLISHED 1836. INCORPORATED 1863.

NEW YORK,
PHILADELPHIA,
CHICAGO,
ST LOUIS,
SAN FRANCISCO.







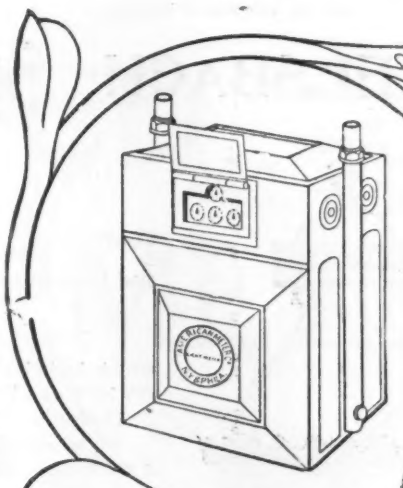
PUBLIC LIGHTING TABLE.

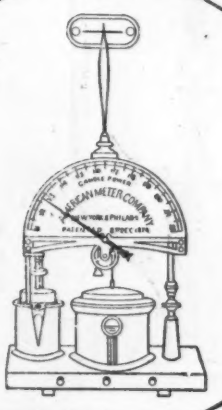
NOVEMBER, 1904.

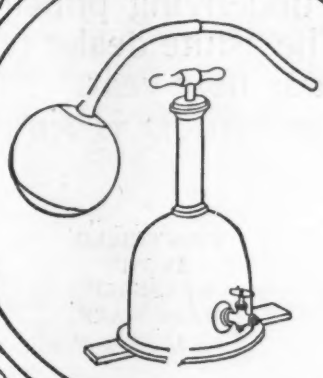
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Tue.	1	5.30 PM	1.30 AM	4.45	5.35
Wed.	2	5.30	2.30	4.45	5.35
Thu.	3	5.30	3.40	4.45	5.35
Fri.	4	5.30	5.30	4.45	5.35
Sat.	5	5.30	5.30	4.40	5.45
Sun.	6	5.20	5.40	4.40	5.45
Mon.	7	5.20 NM	5.40	4.40	5.45
Tue.	8	5.20	5.40	4.40	5.45
Wed.	9	5.20	5.40	4.40	5.45
Thu.	10	5.20	5.40	4.40	5.45
Fri.	11	5.20	5.40	4.40	5.45
Sat.	12	8.30	5.40	4.30	6.00
Sun.	13	9.30	5.50	4.30	6.00
Mon.	14	10.30 FQ	5.50	4.30	6.00
Tue.	15	11.20	5.50	4.30	6.00
Wed.	16	12.20 AM	5.50	4.30	6.00
Thu.	17	1.10	5.50	4.30	6.00
Fri.	18	2.10	5.50	4.30	6.00
Sat.	19	3.10	5.50	4.25	6.00
Sun.	20	4.10	5.50	4.25	6.00
Mon.	21	No L.	No L.	4.25	6.00
Tue.	22	No L. FM	No L.	4.25	6.00
Wed.	23	No L.	No L.	4.25	6.00
Thu.	24	5.10 PM	7.20 PM	4.25	6.00
Fri.	25	5.10	8.10	4.25	6.00
Sat.	26	5.10	9.10	4.20	6.10
Sun.	27	5.10	10.10	4.20	6.10
Mon.	28	5.10	11.20	4.20	6.10
Tue.	29	5.10 LQ	12.20 AM	4.20	6.10
Wed.	30	5.10	1.30	4.20	6.10

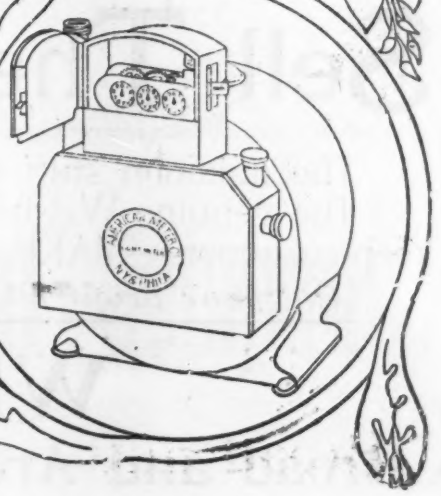
TOTAL HOURS LIGHTING DURING 1904.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	225.00	January	423.20
February	205.40	February	367.40
March	187.40	March	355.35
April	169.50	April	298.50
May	152.30	May	264.50
June	137.20	June	234.25
July	138.50	July	243.45
August	151.00	August	280.25
September	164.40	September	321.15
October	191.30	October	374.30
November	210.30	November	401.40
December	237.10	December	433.45
Total, yr.	2171.40	Total, yr.	4000.00





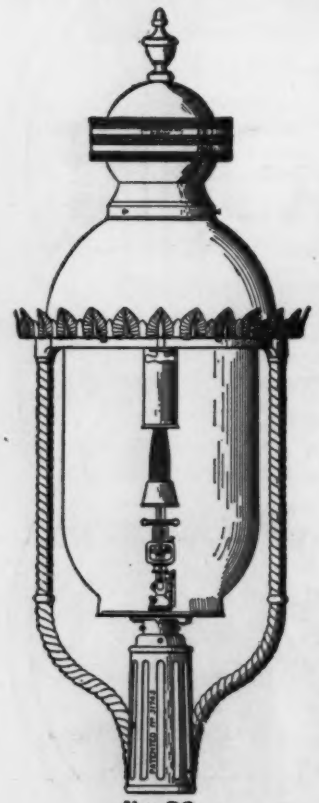




NEW YORK, 97 Liberty Street. BOSTON, 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple-

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

Broad and Arch Sts., PHILADELPHIA.

THE UNITED GAS IMPROVEMENT COMPANY

For the Period Ending July 31st, 1904, has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Augusta, Me.	Tampa, Fla. (3d contract).
Bangor, Pa.	Westchester, N. Y. (3d contract).
Woonsocket, R. I. (2d contract).	Bridgeport, Conn. (2d contract).
Brooklyn, N. Y. (4th contract).	St. Paul, Minn. (2d contract).
Cincinnati, O. (2d contract).	Harrisburg, Pa.
Scranton, Pa. (3d contract).	Pelham, N. Y.
New York City (14th contract).	Reading, Pa.
New Haven Conn. (2d contract).	Springfield, Mass. (2d contract).
Watertown, N. Y.	Lynn, Mass. (5th contract).

TOTAL SETS, 1904, ... 35
TOTAL DAILY CAPACITY, 1904, . . 50,400,000 cubic feet.
TOTAL SETS TO DATE, ... 543
TOTAL DAILY CAPACITY, ... 413,180,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { GAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office:
Cor. Manchester and Sulphur Avenues, St. Louis, Mo.

Established 1845. Reorganized 1902.

The Kreischer Brick Mfg. Co.,

Manufacturers of the very best quality of Clay Retorts, Blocks, Tiles, Settings and Firebrick of every description.

Also Miners and Shippers of Fireclay, Fire Sand, Ground Brick in Barrels.

WORKS: KREISCHERVILLE, STATEN ISLAND.
OFFICE: 119 E. 23D STREET, NEW YORK CITY.

Adam Weber Sons.

GENERAL OFFICES: Park Row Bldg., N. Y. City.
DEPOT & WAREHOUSES: 639 E. 15th St., N. Y. City.
WORKS: Weber, N. J.

ERECTION OF

Modern Coal Gas Plants,

With either Horizontal, Inclined or Vertical Retorts.

PATENTS APPLIED FOR.

No. 1. Firing horizontal benches with pulverized fuel, with either 8 or 10 retorts in 1 setting, using one furnace for two benches. Great saving in labor, fuel and life of retorts and settings. No elaboration of complex recuperation.

No. 2. Independent retort settings, taking all weight from retorts.

No. 3. Vertical retorts with vertical charge and discharge. Sixteen retorts in one bench.

MODERN BENCH IRONWORK.

ISAAC C. BAXTER, President. ESTABLISHED 1864. PETER YOUNG, Sec'y and Treas.

Works.
LOCKPORT STATION, PA.

JAMES GARDNER, JR., CO.,

Address all communications to
JAMES GARDNER, JR., CO., Room 702 Lewis B'l'dg.
PITTSBURGH, PA.

Successor to WILLIAM GARDNER & SON.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1856.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

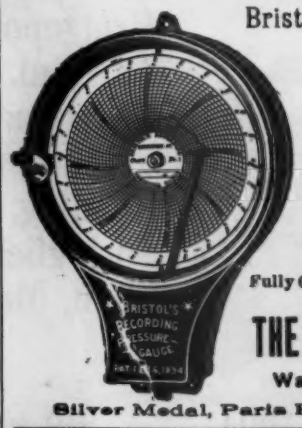
GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. BLOOMINGTON, INDIANA.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, BLOOMINGTON, IND.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.



Bristol's Recording
PRESSURE GAUGE.

For continuous records of Street Gas Pressure.
Simple in construction, accurate in operation and low in price.
Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,
Waterbury, Conn.

Silver Medal, Paris Exposition.

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the Exclusive Agents *for the* Mitchell Patent Benches, *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* Rear Clinkering. The Mitchell *is the* Original Coal Firing Bench. *We also Erect Plain Benches with* One *to* Six Retorts.

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office:
411 Olive Street, Continental Bank,
ST. LOUIS, MO.

Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.

Four-Scoop and Four-Rake Charging and Discharging Machines are operating in Detroit, Mich.

These are the only machines that will draw or charge simultaneously 3 or 4 retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

Hot Coke Conveyor, Quencher and Steam Exhauster, operating in Toronto, Canada, working in water-sealed flue, rollers being protected from heat and grit.

COAL CRUSHERS, CONVEYORS AND BINS. TURNTABLES FOR MACHINES.

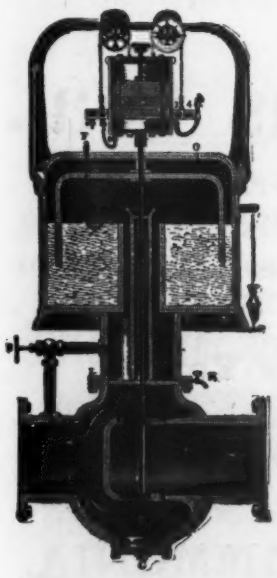
Labor-Saving Machines for Handling Coal and Coke from Coal Cars to Coke Yard or Bins, a Specialty.

G. A. BRONDER,

Contracting Engineer and Builder,

229 BROADWAY, NEW YORK.

CONNELLY IRON SPONGE AND GOVERNOR CO.,



CONSTRUCTORS OF

Coal Gas Apparatus.

Automatic, Balance and Service Gas Governors.
Roots Improved Gas Exhausters.
Iron Sponge for Gas Purification.
Jones Jet Photometers, Pressure Registers, etc.

GAS SPECIALTIES.

395 Broadway, New York. 788 South Canal St., Chicago, Ills.

ARTHUR R. CRUSE, President. FRANK FLAVELL, Secretary. AARON E. KEMPER, Treasurer.

Cruse=Kemper Company,

PHILADELPHIA OFFICES: Stephen Girard Building. - - WORKS: Ambler, Pa.

Manufacturers of

Triple, Double and Single=Lift Gasholders,

With or Without Metal Tanks,

Oil and Water Tanks, Purifier Covers, General Plate Metal Work, and Steel Water Towers.

Plans, Specifications and Estimates Promptly Furnished on Request.

PRACTICAL PHOTOMETRY,

By WILLIAM JOSEPH DIBDIN,

PRICE, $3. FOR SALE BY

A. M. CALLENDER & CO., 42 Pine Street, New York City.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C.

Price, $2.50.

A. M. CALLENDER & CO., 42 Pine St., N. Y. City.

JAMES D. PERKINS, President. F. SEAVERNS, Treasurer.

THE PERKINS COMPANY,

228 and 229 Produce Exchange, New York City.

TIDEWATER SALES AGENTS FOR THE FOLLOWING:

Ocean Mine Youghiogheny Gas Coal,
Old Kentucky Shale and O. K. Boghead.

SHIPMENTS FROM NEW YORK, PHILADELPHIA, BALTIMORE AND NORFOLK.

BERWIND-WHITE COAL MINING COMPANY'S

Ocean Westmoreland Gas Coal.

Offices:
Washington Building, New York.
Betz Building, Philadelphia.

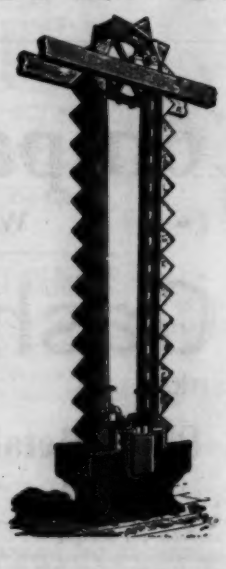
STRICTLY High Grade. . . . .
Carefully Prepared.
For Gas Making or
Heavy Steaming. .

A. C. M. AZOY, General Agent, 1 Broadway, New York.

TYPES OF JEFFREY ELEVATORS AND CONVEYORS.

SEND FOR CATALOGUE.

ADDRESS,
The Jeffrey Mfg. Co.,
Columbus, O.
New York,
Chicago,
St. Louis,
Denver,
Buffalo,
Philadelphia,
Kansas City, Mo.



The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C. Price, $3.50.

Orders may be sent to

A. M. CALLENDER & CO., 42 Pine St., N. Y.

COAL TAR —AND— AMMONIA.

Third and Enlarged Edition.

BY
GEORGE LUNGE, Ph.D.

Price, $15. For Sale by
A. M. CALLENDER & CO.,
42 Pine Street, New York City.

SELF-INSTRUCTION
For Students in Gas Manufacture.

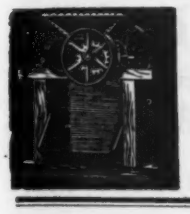
Price, $1.25. For Sale by
A. M. Callender & Co.,
42 Pine Street, New York City.

ELECTRIC GAS LIGHTING.

How to install electric gas igniting apparatus, including the jump spark and multiple systems for use in houses, churches, theaters, halls, schools, stores or any large building. Also, the care and selection of suitable batteries, wiring and repairs.

By H. S. NORRIE.

Price, 50 cents. Orders may be sent to
A. M. CALLENDER & CO., 42 PINE ST., N. Y. CITY.



KELLER ADJUSTABLE COKE CRUSHER.

Strong, Simple, Durable. Will Crush any Size Desired.

C. M. KELLER,
Sec. & Supt. Gas Lt. & Coke Co.,
Columbus, Ind.
Correspondence Solicited.

POOLE ON FUELS.

THE CALORIFIC POWER OF FUELS.

By HERMAN POOLE, F.C.S.

Second Edition. Price, $3. For Sale by

A. M. CALLENDER & CO., 42 PINE ST., N.Y. CITY.

The Gas Engineer's Laboratory Handbook,

By JOHN HORNBY, F.I.C.

Price, $2.50.

FOR SALE BY

A. M. CALLENDER & CO.,
42 Pine Street, New York City.

BINDER for the JOURNAL.

Price, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, N.Y.

EDMUND H. McCULLOUGH, President. CHAS. F. GODSHALL, Treasurer. H. C. ADAMS, Secretary. HENRY WHARTON, Assistant Secretary.

THE WESTMORELAND COAL CO.

Chartered 1854.

Mines situated on the Pennsylvania and the Baltimore and Ohio Railroads, in Westmoreland County, Pa.

POINTS OF SHIPMENT:

PHILADELPHIA, BALTIMORE, SOUTH AMBOY, N. J., WATKINS (SENECA LAKE), N. Y.

Since the commencement of operations by this Company its well-known Coal has been largely used by the Gas Companies of New England and the Middle States, and its character is established as having no superior in gas-giving qualities, and in freedom from sulphur and other impurities.

Principal Office, 224 South 3d St., Phila., Pa.

SUN COMPANY,

PRODUCER, REFINER, SHIPPER AND EXPORTER OF

Petroleum and All Its Products.

Pittsburg, Pa., and Philadelphia, Pa.

THE SUN OIL CO.

Gas Oil, Gas Naphtha,
Refined Oil, Lubricating Oils.

Toledo, O., and Pittsburg, Pa.

BROWNHOIST POWER TRAMRAIL

SYSTEMS FOR HANDLING MATERIAL IN GAS HOUSES.

The Brown Hoisting Machinery Co.,

New York. Cleveland. Pittsburg.

PRACTICAL HANDBOOK ON

GAS ENGINES,

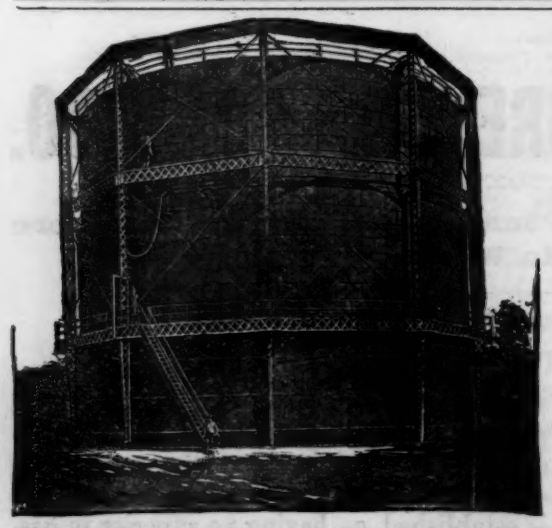
With Instructions for Care and Working of the Same.

By G. LIECKFELD, C.E.

Translated with Permission of the Author, by GEO. M. RICHMOND, M.E.

PRICE, $1.00.

A. M. CALLENDER & CO., 42 Pine Street, New York City.



DAVIS & FARNUM MFG. CO.,

WALTHAM, MASS.

Principal Office & Works, Waltham, Mass. Boston Office, R'm 18, Vulcan Bldg., 8 Oliver St.

Single, Double and Triple-Lift Gasholders of any Capacity. Tubular, Pipe and Sinuous Friction Condensers of all Sizes.

Steel Tanks for Gasholders, Iron Roof Frames and Floors, Purifying Boxes, Center Seal or Valve Connections, Bench Work, Reversible Lime Trays.

Self-Sealing and Pressed Steel Mouthpiece Lids.

Coke Barrows, Coal Wagons, and all Apparatus Requisite for a Complete Gas Works.

Also, Gas and Water Pipe. Flanged Pipe, Sugar House Work, and Special Castings of all Descriptions.

BAXTER & YOUNG,

CONTRACTING AND CONSULTING GAS ENGINEERS.

Examination and Values Ascertained of Artificial and Natural Gas Properties.

COMPLETE GAS WORKS ERECTED.

Artificial and Natural Gas Mains Furnished and Laid.

GAS PROPERTIES PURCHASED.

OFFICE: WAYNE COUNTY BANK BUILDING,

Rooms 201 & 202. DETROIT, MICH.

A. E. BOARDMAN, C. E.,

Consulting and Contracting Engineer.

Particular attention given to Gas, Water and Electric Plants. Long and successful experience with the problem and practice of

Filtration for Public Water Supply.

Edison Building, 42 and 44 Broad St.,

NEW YORK CITY.

Geo. Shepard Page's Sons.

GAS MACHINERY.

Correspondence Solicited.

180 Fulton Street, New York City.

DAVID LEAVITT HOUGH,

Consulting Engineer

AND

CONTRACTOR,

PARK ROW BUILDING, N. Y.

Established 1876.

National Paint Works.

PAINTS FOR METAL SURFACES.

We Sell 85 Per Cent. of the Gasholder Paint in the United States.

SALES OFFICE:	FACTORY:	SALES OFFICE:
Great Northern Bldg., Chicago.	Williamsport, Pa.	92 William Street, New York City.

KERR MURRAY MANUFACTURING COMPANY,

Engineers and Manufacturers

APPARATUS FOR COAL GAS PLANTS,

SINGLE AND DOUBLE-LIFT GASHOLDERS AND STEEL TANKS,

Latest Improved

ROTARY EXHAUSTERS, P. & A. TAR EXTRACTORS, AMMONIA WASHERS,

CONDENSING, SCRUBBING AND PURIFYING APPARATUS.

Street Specials and Valves.

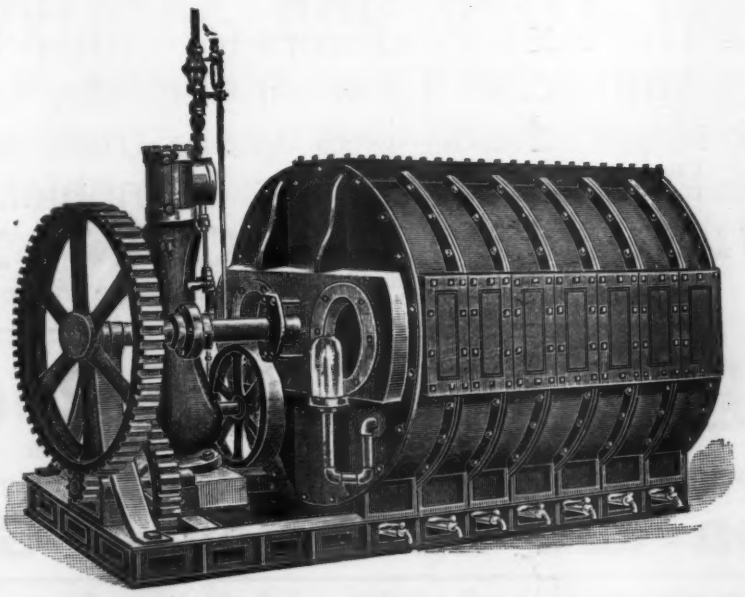
ADDRESS:

KERR MURRAY MANUFACTURING COMPANY, {FORT WAYNE, IND.

BARTLETT, HAYWARD & CO.

BALTIMORE, MD.

Designers and Builders of Gas Works.



Sole Lessees the Wilkinson Water Gas Process.

PATENT STANDARD WASHER-SCRUBBER.

The best apparatus for the extraction of all Ammonia and a large proportion of Carbonic Acid and Sulphureted Hydrogen. The Scrubber has been materially improved and is provided with patented Wooden Segmental Grids, instead of Metallic Discs, thus reducing the weight on shaft and power for operating same.

Coal and Water Gas Installations of the Most Modern and Complete Types.

BENCHES WITH INCLINED RETORTS.

System Stettiner Chamotte Fabrik, Actien Gesellschaft, of Stettin, Germany.

GASHOLDERS OF ALL SIZES.

General Western Agents, THE LLOYD CONSTRUCTION CO., of Detroit, Mich.

QUINTARD IRON WORKS,

N. F. PALMER,

Foot of 12th St. & East River, New York,

MANUFACTURERS OF

GAS APPARATUS.

Complete Works Erected.

FREDERICK W. FLOYD, Engineer.

ALEX. C. HUMPHREYS, M.E., Sc.D., M.Inst.C.E. ARTHUR G. GLASGOW, M.E., M.Inst.C.E.

HUMPHREYS & GLASGOW,

CONSULTING ENGINEERS.

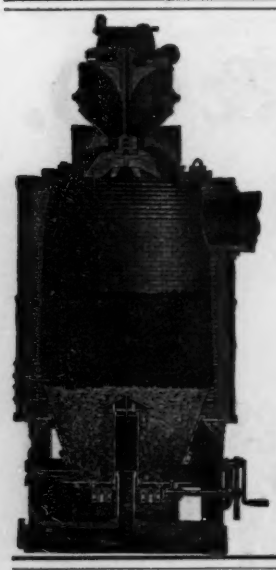
BANK OF COMMERCE BLDG., 31 Nassau Street, New York.

38 VICTORIA STREET, London, S. W., England.

ADVICE AS TO EXTENSION AND RECONSTRUCTION OF GAS AND ELECTRICITY PLANT.

COMPLETE EXAMINATIONS MADE.

PROPERTIES PURCHASED.



R. D. WOOD & CO.,

400 CHESTNUT STREET, PHILADELPHIA,

—BUILDERS OF—

Gas Power Plants with Producers,

The best Producers for either Bituminous, Anthracite Coal or Lignite. Less labor required and less waste than in any other Producer. Send for Pamphlet. : : : :

CAST IRON PIPE.

HYDRAULIC TOOLS. HYDRAULIC OPERATING VALVES.

ISBELL-PORTER CO.,

ENGINEERS AND CONTRACTORS FOR THE

Construction and Extension of Gas Works.

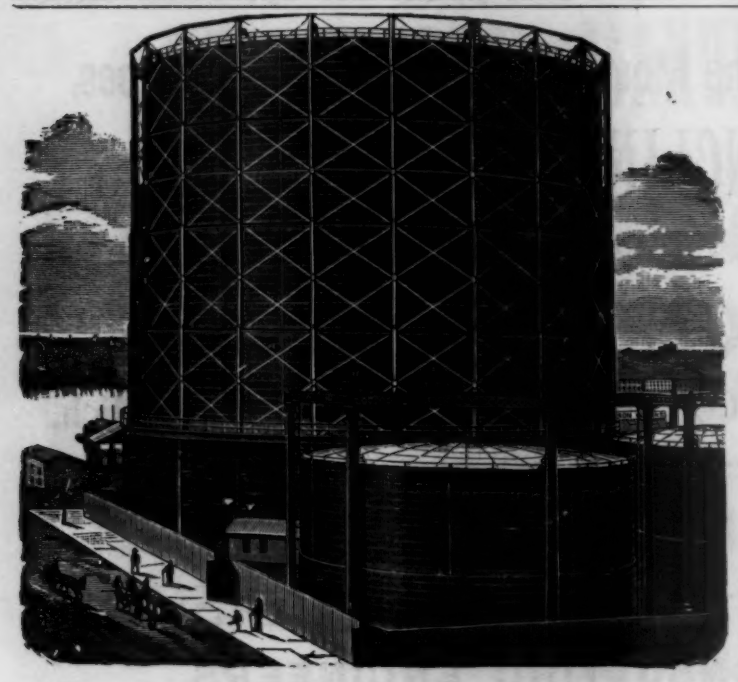
TOTAL ROTARY AMMONIA SCRUBBERS SOLD,

98,806,000 Cu. Feet Daily Capacity.

TOTAL WALKER TYPE TAR EXTRACTORS SOLD,

84,900,000 Cu. Feet Daily Capacity.

OFFICE AND WORKS: Bridge and Ogden Streets, Newark, N. J.



The Continental Iron Works,

THOMAS F. ROWLAND, President.
WARREN R. HILL and CHAS. H. CORBETT, Vice-Presidents.
THOMAS F. ROWLAND, Jr., Secretary & Treasurer.

West and Calyer Sts. (Near 10th & 23d St. Ferries)
NEW YORK, Borough of Brooklyn.

BUILDERS OF

Gas Holders.

Single and Multiple Section Gas Holders a Specialty.

STEEL GAS HOLDER TANKS.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc.

Self-Sealing Retort Mouthpieces & Lids

For Round, Oval, or "D" Retorts.

THE GAS ENGINEER'S LABORATORY HANDBOOK,

By JOHN HORNBY, F.I.C.

PRICE, - - - - - - - $2.50.

A. M. CALLENDER & CO., No. 42 Pine Street, New York City

THE STACEY MANUFACTURING COMPANY,

MANUFACTURERS AND BUILDERS OF

GASHOLDERS AND STEEL TANKS

AND ALL IRONWORK AND MACHINERY REQUIRED IN A GAS PLANT.

Also Oil Storage Tanks, Steel Roofs, Stand Pipes, Etc.

We also manufacture Lamp Posts, Gas Valves, all size and shape Castings, Etc.

Makers of Apparatus for THE CHOLLAR PROCESS OF PURIFICATION.

Plans, Specifications and Estimates Cheerfully Furnished on Request.

GENERAL OFFICES:

No. 239 Mill Street, CINCINNATI, OHIO. 'Phone, West 690.

EASTERN SALES AGENT:

FRANK D. MOSES, 7 North Stockton Street, TRENTON, N. J.

RITER-CONLEY MFG. CO.,

GASHOLDERS, with or without Steel Tanks.

Purifiers, Condensers, Scrubbers, Oil Tanks, Smoke Stacks.

STEEL ROOFS and BUILDINGS.

PLATE AND STRUCTURAL WORK OF EVERY DESCRIPTION.

GENERAL OFFICE: Pittsburg, Pa. EASTERN OFFICE: 39-41 Cortlandt St., New York City.

J. ALEX. MAYERS,

44 BROAD STREET, NEW YORK CITY,

GAS ENGINEER AND CONTRACTOR

FOR THE ERECTION OF

COMPLETE GAS WORKS

OR ANY PART THEREOF.

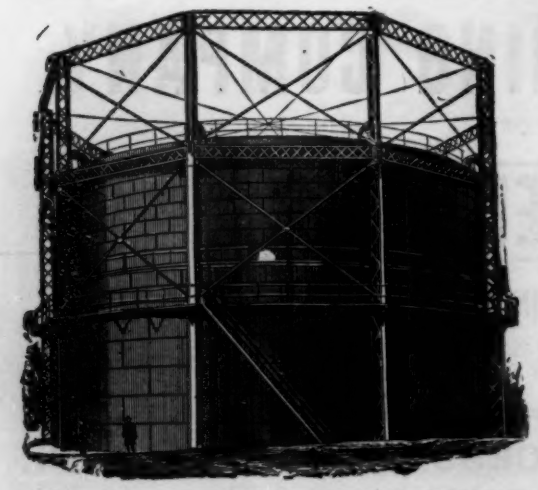
CORRESPONDENCE PROMPTLY ANSWERED.

1904 DIRECTORY 1904

OF AMERICAN GAS COMPANIES.

Price, - - - - - - - - $5.00.

A. M. CALLENDER & CO., - - No. 42 Pine Street, New York.



1842 ❊ Deily & Fowler, ❊ 1904

LAUREL IRON WORKS.

Office, No. 39 Laurel Street, Philadelphia, Pa.

BUILDERS OF

Gasholders

Single or Telescopic. With or Without Iron or Steel Tanks.

OIL TANKS, WATER TANKS, AND GENERAL WROUGHT IRON WORK.

The order for this Triple-Lift Holder and Steel Tank was received by the Logan Iron Works from the Union Gas Light Company, of East New York. The contract was completed and the Holder was in actual use in 90 days from receipt of order. Capacity of Holder, 500,000 cu. ft.

LOGAN IRON WORKS,

Brooklyn, N. Y.,

MANUFACTURERS OF

Single or Multiple-Lift

GASHOLDERS,

Complete, with Steel Tanks.

BENCHES, SCRUBBERS,
CONDENSERS,
PURIFIERS, IRON ROOFS,

AND ALL PARTS OF

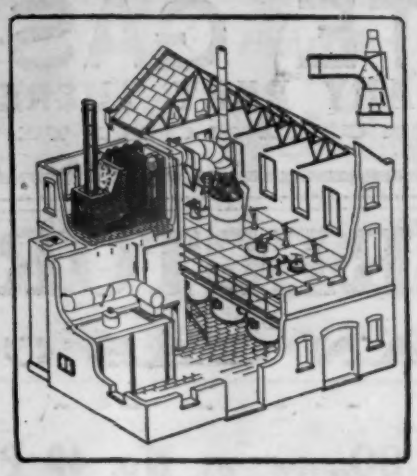
GAS WORKS APPARATUS.

Contractors for Complete Works.

Economize Heat in Water Gas Plants,

BY UTILIZING A

Green's Economizer,



To absorb the heat now going to waste when you blow through your superheater to heat the feed water for your boilers to the temperature of the steam. This is now being done at the Poughkeepsie Gas Works, Poughkeepsie, N. Y. : : : : :

Write for full particulars how this is accomplished, the saving effected, and the advantages gained, to the

GREEN FUEL ECONOMIZER CO.,
MATTEAWAN, N. Y.

Established 1854.

D. McDONALD & CO.,

MANUFACTURERS OF

WET AND DRY METERS, STATION METERS AND METER PROVERS.

ALSO MAKERS OF

THE GLOVER PREPAYMENT METER.

The amount of gas delivered for the coin can be instantly and positively changed without removing the meter or replacing any parts.

The gas registered agrees absolutely with the amount purchased by the coin.

WE HAVE MADE AND SOLD IN THE UNITED STATES

OVER 120,000 OF THESE METERS,

ALL OF WHICH ARE GIVING PERFECT SATISFACTION.

Correspondence Solicited.

561 West Forty-seventh Street, NEW YORK. | 51, 53 & 55 Lancaster Street, ALBANY, N. Y. | Jefferson and Monroe Streets, CHICAGO.

THE CONNERSVILLE BLOWER CO.,

MANUFACTURER OF

ROTARY POSITIVE PRESSURE GAS EXHAUSTERS, BLOWERS AND PUMPS.

HORIZONTAL OR VERTICAL, IN CAPACITY RANGING FROM 9,000 to 1,800,000 CU. FEET DISPLACEMENT PER HOUR.

CONNERSVILLE BLOWER CO., Connersville, Ind. EASTERN SALES OFFICE: 95-97 Liberty St., New York City.

We Have Sold Over 50,000 of Our

PREPAYMENT GAS METERS

IN NEW ENGLAND.

We Have Fitted Up Over 10,000 Idle Regular Meters with Our

PREPAYMENT ATTACHMENT.

Can be Attached to Any Make of Meter.

NATHANIEL TUFTS METER COMPANY, 8 MEDFORD STREET, BOSTON, MASS.

MARYLAND METER CO.,

BALTIMORE, North and Saratoga Streets. **CHICAGO, 88 to 92 Jackson Boulevard.**

CONSUMERS' AND STATION METERS, PRESSURE GAUGES, ETC.

SPECIAL ATTENTION GIVEN TO ALL REPAIR WORK.

"Have you Seen our Complaint Meter?"

We will furnish meters with the Beal Straight Reading Index, when desired. Either regular or prepayment Repairs changed to straight reading. Write for terms.

KEYSTONE METER CO., Royersford, Pa.

DETROIT STOVE WORKS

"Largest Stove Plant in the World"

MANUFACTURES AND SELLS

DETROIT JEWEL GAS APPLIANCES

FOR COOKING and HEATING,

All about which is told in a fine and strictly "to-the-point" catalog, sent upon request to Gas Companies.

DETROIT, MICH. CHICAGO, ILLS.

AMERICAN METER COMPANY,

NEW YORK, PHILADELPHIA, CHICAGO.
SAN FRANCISCO, ST. LOUIS.

PREPAYMENT METERS.

THEIR CONSTRUCTION IS SUCH THAT THEY MAY BE READILY READJUSTED WHEN THE SCALE OF GAS RATES IS CHANGED.

HELME & McILHENNY,

Established 1848. **1339 to 1349 Cherry Street, Philadelphia, Pa.**

MANUFACTURERS OF

Wet and Dry Gas Meters, Station Meters, Provers, Gauges, Etc.

METERS REPAIRED

PREPAYMENT GAS METERS.

Our Own Patents. Strong. Simple. PROMPT ATTENTION. CORRESPONDENCE SOLICITED.

METRIC METAL COMPANY,

MAKERS OF

GAS METERS for NATURAL and ARTIFICIAL GAS.

Special Attention given to Repairing METERS of all Makes.

FACTORY AT ERIE, PA.

MANY DEATHS

have been caused by slot meters, through gas being inadvertently turned on in sleeping rooms. The Reeves' Attachment entirely prevents the possibility of such an occurrence, because the gas does not go out for 10 or more hours. Drops to a small flame, and amount so used is automatically deducted from next prepay. Other important improvements.

REEVES MFG. CO., - - - - - New Haven, Conn.

JOHN J. GRIFFIN & CO.,

1513 TO 1521 RACE STREET,

559 West 47th Street, NEW YORK.

PHILADELPHIA.

Jefferson and Monroe Streets, CHICAGO.

MANUFACTURERS OF

GAS METERS,

Station Meters and Experimental Apparatus of Every Description.

PROMPT ATTENTION GIVEN TO ALL REPAIRING.

OUR SPECIAL NATURAL GAS METER

Is the Best ever offered. Over 75,000 now in use.

The Positive Prepayment Meter.

Positive Advantages:

The Income is Quick and Sure.

IT IS

Better than C.O.D.,

As Gas is Paid for Before Delivery. : : :

There is Money in it ☞

For the gas man.

IT WILL GET NEW CUSTOMERS.

It will KEEP the ones you have.

Negative Advantages:

No "Deposit" is Necessary to Start Business with a new customer. : : :

NO CUSTOMERS ARE LOST on that account.

No Time Lost Making Out Bills.

No Money Lost on account of Unpaid Bills. :

No Disputes on Account of Bills.

THE PREPAYMENT SYSTEM IS PROFITABLE FOR THE GAS MAN AND PLEASANT FOR THE CONSUMER.

OVER 160,000 OF THE POSITIVE PREPAYMENT METERS ARE IN USE IN THE UNITED STATES.

SEND FOR OUR BOOKLET.